YOU ARE Always CLOSE TO THOMAS STEEL

Thomas Strip

COLD ROLLED STRIP STEEL
ELECTRO ZINC COATED
ELECTRO COPPER COATED
ELECTRO NICKEL COATED
ELECTRO BRASS COATED
BRIGHT FINISH UNCOATED

Wherever you go . . wherever you may be, there is a product near by that has in it Thomas Cold Rolled Strip. The reason for this is that manufacturers have found that Thomastrip offers distinct money and time saving advantages in that it can be had in special finishes. The Thomas Steel Company with their sales and production departments right at the mill afford immediate answers to your production problems. Do as others do, use Thomastrip for your product.

THE THOMAS STEEL CO. Warren, O.
Specialized Producers of Cold Rolled Strip Steel

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Reg. U. S. Pat. Off.
Published Weekly

Volume 78 Number 2

JULIAN CHASE, Directing Editor
HERBERT HOSKING, Editor
P. M. HELDT, Engineering Editor JAMES U. STEINFIRST, News Editor
JOS. GESCHELIN, Detroit Technical Editor GEOFFREY GRIER, Art Editor
HAROLD E. GRONSETH, Detroit News Editor MARCUS AINSWORTH, Statistician
JEROME H. FARRIS, Ass't Editor L. W. MOFFETT, Washington Editor
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C. A. MUSSELMAN, Pres.; J. S. HILDRETH, Vice-Pres. and Manager, Automotive Division; G. C. BUZBY, Vice-Pres.

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Published Weekly
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AUTOMOTIVE INDUSTRIES

January 8, 1938
Vol. 78, No. 2

Production

Output Outlook Helped by Hudson; Overall Picture Unchanged

Brightest spot in the Detroit industrial picture this week was the Hudson Motor Car Co.'s announcement of its new low-priced car, the Hudson 112, requiring addition of 6000 workers and an expenditure estimated at $11,000,000 for tools, production materials, and other costs.

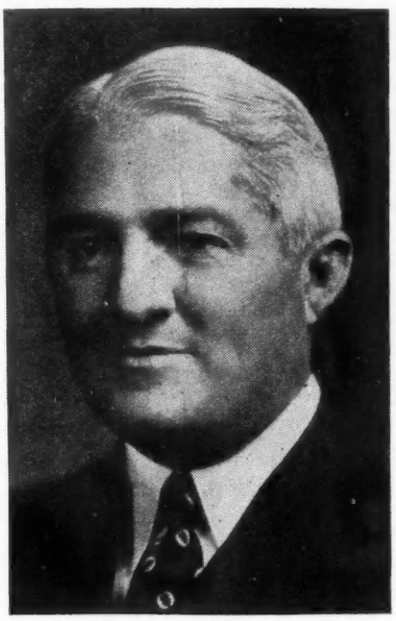
The company has gone back on a five-day week while producing sufficient models to stock its dealer organization and expects to be operating at capacity until these requirements have been met, by which time it will be in a position to determine what its normal production requirements will be.

Generally speaking the production picture has not changed insofar as the other manufacturers are concerned. Some plants are closed entirely and others are working on a two, three or four-day basis. All are prepared to go into production or to step up production just as rapidly as demand develops. There is a feeling that the picture will brighten but in the meantime every effort is being made to help dealers move used cars.

Ford is maintaining its estimated requirements of better than 20,000 units a week, and Packard reopened this week after a brief inventory period. General Motors units are operating on a three-day week as recently announced by W. S. Knudsen, president, while Chrysler plants remain inoperative.

Graham and Nash operated for two days while Hupmobile, Studebaker and Willys were not active, the latter two because of inventory. Hupmobile expects to operate at least two days next week.

Estimated production for the week is expected to be in the neighborhood of 47,000 units, of which Ford will account for some 20,000 and General Motors better than 24,000. If this pace is maintained during the rest of January the month will finish close to 200,000 units, but that figure is subject to revision either upward or downward depending on demand.



A. E. BARIT

. . . president of Hudson Motor Car Co., who this week announced the company's offering of a new low-priced car as part of an $11,000,000 plan to put "men and money back to work."

In his speech disclosing the details of the move to a group of publishers and editors Mr. Barit said, "If the automobile industry was able to lead the way out of the depression, it seems reasonable to expect it to do something about leading the way out of the recession."

Hudson 112 Prices

Prices for Hudson's new car, fully equipped and delivered in Detroit, begin at $694, plus local tax, for the 3-passenger coupe. The Victoria 4-passenger coupe is priced at $740, plus local tax; and the 6-passenger sedan is $755, plus local tax.

Labor

GM "Playing Pretty Fair Game," Says UAW's Homer Martin

Three developments having a direct bearing on the labor situation in the Detroit area came in for comment from union officials during the past week.

First of these was the petition of the Ford Motor Co. to the National Labor Relations Board to set aside its recent finding of "unfair labor practices" and "cease and desist" order and to give the company a rehearing on the case based on the original complaint. (See article on page 38, "Ford Petitions NLRB.")

Homer Martin, president of UAW, returned to Detroit after a two weeks' absence to dispute the company's claim of new evidence.

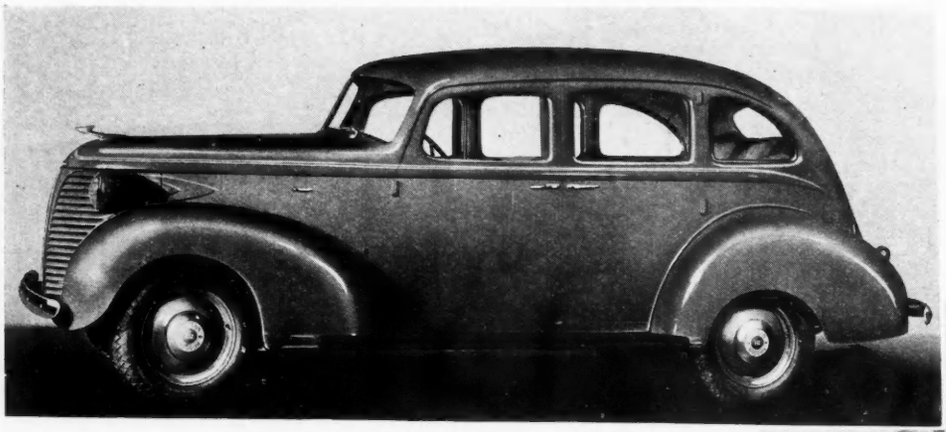
"If the company had a better case, as it now claims, it should have presented it during the hearing," he said. "I think the labor board hearings in St. Louis and Kansas City will prove that all of the allegations made by the UAW here have been duplicated in both those cities."

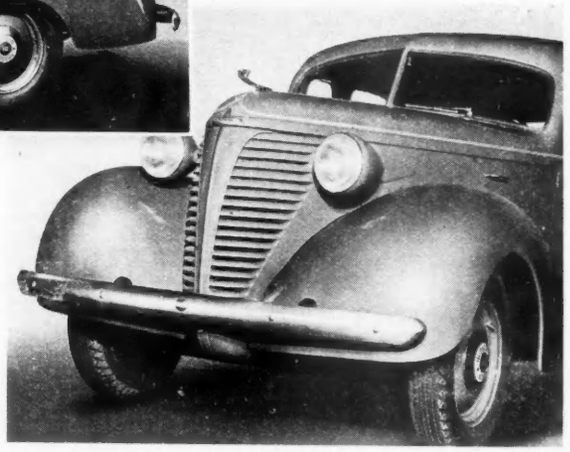
The NLRB denied Ford's petition on Jan. 5 and the board indicated that it was preparing to begin suit immediately in a Federal circuit court of appeals for an order enforcing compliance with its recent decision.

Simultaneously with the decision of the board, the company, through P. E. Martin, vice-president, filed a reply in Detroit with Frank H. Bowen, regional director of the NLRB, denying that it had violated the law, is now violating the law, or intends to violate the law.

In connection with the recent layoff of 30,000 men in General Motors plants Mr. Martin questioned the necessity for the layoffs but remarked that the corporation was "playing a pretty fair game" in adhering to its agreement with

(Turn to page 36, please)





Two views of the new Hudson 112, equipped with 83-hp. engine

Hudson Announces New Car In "Lowest Price Field"

The Hudson Motor Car Co. this week announced its entry into the lowest price passenger car field with a new car to be known as the Hudson 112. Production is now underway with some 20,000 units estimated as immediately required to stock the company's 5000 retail outlets. Output rate will be geared to demand and the assembly line will be able to turn out 3500 cars a week if necessary.

As part of the company's announced plan to put "men and money back to work," the firm will double its working force to 12,000 men and will expend approximately $11,000,000 for tools and production materials. The factory payroll will be increased by $1,250,000 per month.

The entire working force will go on full time Jan. 10 and will work five eight-hour days each week. The new car will be produced on the same production line now handling present Hudson models.

Mounted on an entirely new 112-in. wheelbase chassis, the new car is 187½ in. long over-all. It is powered by a six-cylinder engine rated 83 hp. at 4000 r.p.m. Bore and stroke dimensions of the engine are 3 in. by 4⅛ in., respectively, making the piston displacement 175 cu. in. The cylinder head is cast iron.

While the line will include nine models, early production schedules are limited to four body types: sedan, 3-passenger coupe, 4-passenger coupe, and a convertible brougham. No rumble seats are provided, the extra space being within the body.

A. E. Barit, president of the Hudson Motor Co., in addressing a group of publishers and editors early this week emphasized the significance of the move, asserting that the expanded activity and employment were more important than the preview of the new car. Mr. Barit said, "It has become increasingly clear to us that with business slowing down as it has recently we were in a position to do more than announce a new automobile, we could in a way set the pace in the matter of putting men and money back to work. The automobile industry was credited a few years

Canadian hard red spring wheat continued keen, but sales were insignificant despite a sharp advance in premiums. No. 1 Northern went to 25

attended. The bank was founded in July, 1929, and now has resources totaling $2,500,000. L. Wilson Dayton is president.

tion industry can revive with help of the Administraton, the last three-quarters of 1938 should be very good.

A New Car Is Coming in the Lowest Price Field

A *new* lowest priced car, which will give to its owners a combination of size, room, smooth performance, sturdiness and safety on the one hand . . . and remarkably low cost of ownership and operation on the other . . . such as has never been offered in any other lowest priced car.

* * *

A lowest priced car in which every major unit . . . motor, transmission, axles, brakes, frame, body . . . is of design, materials and construction proved and steadily improved through well over twenty years . . . yet *new* in the lowest price field.

* * *

This car will be offered by the one manufacturer who is fully qualified, by experience, plant facilities and methods, and organization set-up to produce this really new type of lowest priced car. A company which has introduced probably more important motor car advancements . . . things which have changed the trend of the industry . . . than any other.

* * *

In short, here will be a better deal for the lowest priced car buyer's dollar . . . a car which matches ECONOMY and PRICE with the very lowest, and which matches ROOM and important FEATURES with the largest and highest priced.

* * *

If you are interested in learning more about this car, write Post Office Box 1221, Detroit, Mich., and full information will be sent you as soon as details can be released. Dealers' telegrams addressed to this box number will be answered promptly and in strict confidence.

TEASER This advertisement calculated to whet public curiosity was inserted in a number of newspapers by the Hudson Motor Co. immediately preceding formal announcement of the new Hudson 112.

Coincident with release of details of the new low-priced line, A. E. Barit, president of the Hudson Motor Car Co., announced that the firm's plan to put "men and money back to work" would involve doubling the number of employes to 12,000 and expenditure of approximately $11,000,000 for tools and production materials.

DIESEL ROAD SHOW One of six new trucks with bodies built by Schelm Bros., Inc., to be used by the Caterpillar Tractor Co. for transporting the 1938 Diesel shows. Four of these trucks are Model EH Mack units; two others, intended for use on the West Coast, are General Motors models.

The Mack units are rated approximately 4 tons and have 194-in. wheelbase. Bodies having a capacity of approximately 525 cu. ft. are equipped with a trolley hoist arranged the entire inside length and extensible 4½ ft. outside. The hoist has a 1000 lb. lift.

These trucks weigh 18,000 lb. loaded and are completely outfitted with directional signal lights, radios, heaters, and dual equipment throughout.

ago with leading the way toward an uptrend for business. It seems possible to expect it to do something about leading the way out of the recession."

Shaw Resigns from Oldsmobile

R. M. W. Shaw, assistant general sales manager at Oldsmobile, announced his resignation from the Oldsmobile organization on Jan. 1.

Mr. Shaw had been associated with Oldsmobile more than 15 years. For eight years he served as advertising manager in Lansing. When the Olds sales organization was moved to Detroit as part of the Buick-Olds-Pontiac Sales Company in 1932, he headed up the Oldsmobile sales activities for that organization.

In 1934 he was appointed assistant general sales manager in charge of the eastern half of the country.

GM Forms Dealer Board

New "Relations" Group Consists of Sloan, Knudsen, Brown, and Smith

Establishment of a "Dealer Relations Board" by the General Motors Corp. was announced this week by Alfred P. Sloan, Jr., chairman, who heralded the move as "an important step forward in industrial management." The board will be composed of the four ranking officers of the corporation: W. S. Knudsen, president; Donaldson Brown, vice-chairman of the board; John Thomas Smith, vice-president in charge of legal affairs; and Mr. Sloan, chairman of the newly created group.

In his announcement statement Mr. Sloan said, "The functions of the board will be to provide an organized opportunity, through a definite operating procedure, whereby any dealer holding a selling franchise, may obtain . . . a judicial review of any administrative decision which, according to the dealer's belief, importantly affects his equitable rights."

Aircraft Exports Go Skyward with 500% Gain

Eyecatcher in the export statistics for November, 1937, and 11 months ended this November, is the meteoric leap upward in dollar volume of exported airplanes, seaplanes, and other aircraft. This figure for November, 1937, is reported at $3,135,979, an approximate 500 per cent increase over the same month last year. Comparison of the dollar volume of exported airplanes, seaplanes, and other aircraft for the first 11 months of 1937 with a similar period in 1936 shows an increase of approximately 121 per cent.

Dollar volume data on exports of automobiles, parts, and accessories reveals the figures for the first 11 months, 1937, leading those for the same period last year by more than 45 per cent. Other 1937 increases in the comparison of dollar volume figures for this period with 1936 are: passenger cars and chassis, 33.8 per cent; motor trucks, buses and chassis (total), 77 per cent; parts, except engines and tires, 32.6 per cent; Diesel and semi-Diesel engines, 121 per cent.

Imports of automobiles (dutiable) gained in dollar volume over the first 11 months of 1937, as compared with 1936, approximately 121 per cent.

	NOVEMBER 1937		NOVEMBER 1936		ELEVEN MONTHS ENDED NOVEMBER 1937		1936	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles, parts and accessories		$ 29,799,719		$ 21,218,061		$ 307,135,229		$ 211,436,023
PASSENGER CARS								
Passenger cars and chassis	24,491	15,304,295	19,918	11,739,576	202,022	118,539,304	155,310	88,635,242
Low price range $850 inclusive	21,334	12,045,614	18,427	10,144,598	183,767	98,615,091	142,872	74,613,123
Medium price range over $850 to $1,200	2,834	2,657,284	1,269	1,188,681	15,351	14,499,644	10,106	9,675,310
$1,200 to $2,000	202	298,249	145	222,210	2,057	3,139,306	1,542	2,304,962
Over $2,000	121	303,148	77	183,787	847	2,285,263	790	2,041,847
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total)	11,444	7,099,544	7,374	3,651,063	142,976	86,770,947	95,386	49,036,933
Under one ton	934	396,559	884	324,411	17,916	7,244,132	14,309	5,465,946
One and up to 1½ tons	7,793	3,975,540	5,532	2,365,310	92,948	45,952,139	65,149	29,513,237
Over 1½ tons to 2½ tons	1,626	1,298,491	757	589,808	22,905	18,081,718	12,474	9,249,040
Over 2½ tons	1,040	1,364,381	197	360,316	7,900	14,429,583	2,572	3,887,607
Bus chassis	51	64,573	4	11,218	1,307	1,063,375	1,882	921,103
PARTS, ETC.								
Parts except engines and tires		2,860,842		2,674,690		48,384,498		36,464,087
Automobile unit assemblies		3,109,678		2,138,658		35,003,117		24,328,700
Automobile parts for replacement (n.e.s.)		510,992		308,788		4,481,932		3,066,172
Other automobile accessories (n.e.s.)		524,274		413,707		5,978,715		4,202,042
Automobile service appliances								
Airplanes, seaplanes and other aircraft	76	3,135,979	32	525,224	590	20,543,804	435	9,310,837
Parts of airplanes, except engines and tires		1,421,385		553,749		10,197,230		5,643,262
INTERNAL COMBUSTION ENGINES Stationary and Portable								
Diesel and semi-Diesel	52	244,721	36	58,758	799	2,150,977	358	970,915
Other stationary and portable								
Not over 10 hp.	3,435	142,845	1,323	77,962	18,973	1,053,420	12,308	711,160
Over 10 hp.	221	131,868	126	78,982	3,129	1,530,927	2,075	938,686
Engines for:								
Motor trucks and buses	826	101,115	1,817	175,099	28,602	2,844,577	20,228	1,979,658
Passenger cars	5,572	331,780	2,374	129,781	75,349	5,058,577	40,778	2,791,859
Aircraft	97	649,973	58	207,773	968	5,433,388	785	4,336,217
Accessories and parts (carburetors)		216,249		152,894		2,533,487		1,778,763
IMPORTS								
Automobiles (dutiable)	107	57,569	106	74,706	1,843	1,106,135	981	500,914

MEN OF THE INDUSTRY

A. B. JONES, chairman of the New York City Tunnel Authority and for many years first vice-president of the B. F. Goodrich Co., Akron, has been reelected to the Goodrich board of directors to succeed **C. B. RAYMOND** who has resigned because of ill health.

WENDELL H. WELCH, assistant director of service, Chrysler Corp., export division, has been placed in charge of all Chrysler Corp. field service activities, and the development of distributor's service facilities for all countries outside of the United States.

DAVID L. SAXON, has resigned as sales manager of the Steel Materials Corp., Detroit. Mr. Saxon intends to open an office in Detroit as a manufacturer's representative to automotive and allied industries.

AL PARR, veteran traffic manager of the Nash Motors Division of Nash-Kelvinator Corp., Kenosha, Wis., has retired. **ELMER SWARTZ,** assistant traffic manager has been appointed as Mr. Parr's successor.

STANLEY S. DUNN, has been appointed assistant to A. C. Tiedemann, director of business management, Nash Motors Division of Nash-Kelvinator Corp., Kenosha, Wis.

J. P. WOODLOCK, manager of petroleum sales for the B. F. Goodrich Co., Akron, has resigned to join the Crucible Steel Co. of America in New York City.

WILLIAM SEWALL, Woodlock's assistant, has been advanced to the managership of the department.

Labor

(Continued from page 33)

UAW on seniority. In the relatively few instances where there have been disputes the difficulties are being negotiated, he said.

Announcement by Hudson Motor Car Co. of its new Hudson 112 to be sold in the low price class and resultant employment of 6000 additional workers was greeted with enthusiasm in UAW headquarters.

"We are pleased to know that Hudson has not been deterred by the current recession and is showing confidence in the future by putting men back to work instead of laying them off," said Martin. "Our relations with Hudson are satisfactory and their action at this time is gratifying."

The UAW is now attempting the huge task of organizing Ford workers by calling on them at their homes. The city has been divided into 44 districts with a union organizer in each district. UAW members have been assigned to cover workers in their immediate neighborhood and to supply union headquarters with information as to the worker's nationality, relatives in the union, and other pertinent data. Organizers, sometimes in company with translators, then call on the workers and solicit their membership. Reasons for not joining are noted and are made the subject of radio announcements in daily broadcasts sponsored by the Ford organizing committee.

UAW headquarters estimate that between 45 and 50 per cent of its membership is not working at the present time. It admits that there have been lay-offs of organizers but others are said to have been transferred to the Ford organization drive.

Ruddon New Federal Truck Head

R. W. Ruddon, for several years vice-president and general manager of the Federal Motor Truck Co., was elected president this week. M. L. Pulcher, who served as president since the company was formed in 1911, has resigned and will retire from business.

Sealed Power Adopts New Finish

A new finish for the wearing surfaces of piston rings, known as Granoseal, has been adopted by the Sealed Power Corp., Muskegon, Mich. The process forms a layer of ferroso-ferric phosphate on the surface of the rings, which is said to be non-scuffing, to absorb oil, and to be resistant to wear. No high temperatures, which might affect the grain structure of the iron of the ring, are employed in the process, and the performance of the rings therefore is not adversely affected in any way.

The objects of the new finishing method are to prevent scuffing, to expedite the running-in process, and to protect the ring under conditions of scanty lubrication. The coating formed by the process also is claimed to give protection against corrosion when the engine is cold and corrosive compounds are formed from the products of combustion.

11 Months' New Car Registrations* Up 7.1%

Examination of the tabulation below discloses a decrease of slightly more than 3.6 per cent in new passenger car registrations for November, 1937, as compared with the figures for the preceding month.

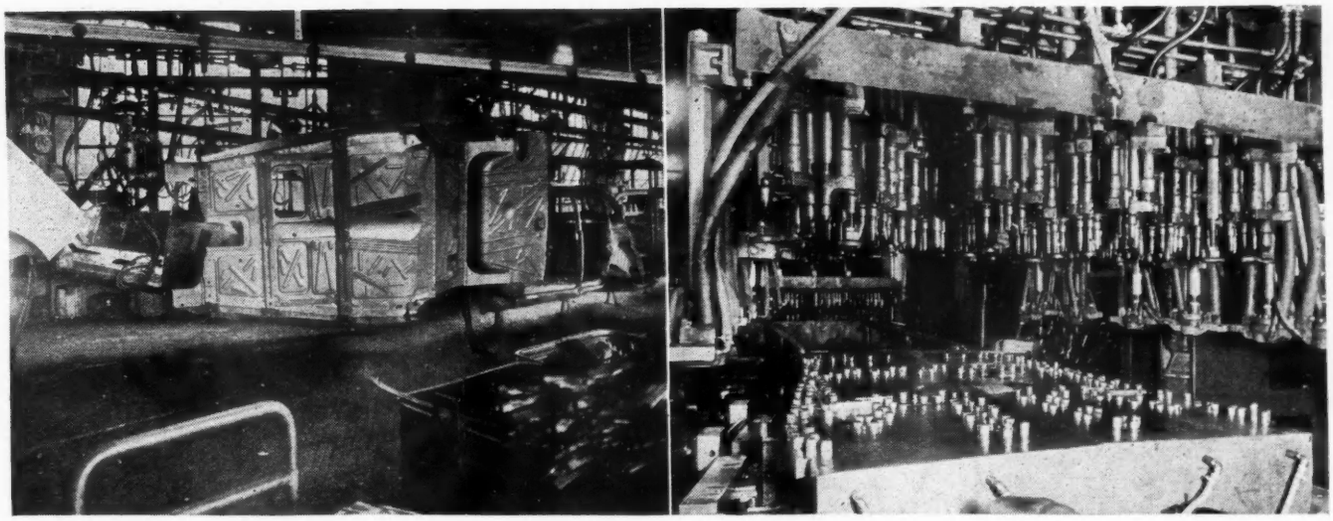
The November, 1937, total of 190,185 new registrations falls short of the November, 1936, mark by approximately 12.6 per cent.

	November 1937	October 1937	November 1936	ELEVEN MONTHS 1937	ELEVEN MONTHS 1936	Per Cent Change, 11 Mos., 1937 over 1936	Per Cent of Total Eleven Months 1937	Per Cent of Total Eleven Months 1936
Ford	15,071	35,028	27,060	727,348	678,569	+ 7.2	22.26	22.27
Chevrolet	57,095	45,209	61,509	713,026	840,912	− 15.0	21.82	27.61
Plymouth	26,125	23,840	41,656	434,764	448,538	− 3.5	13.31	14.73
Dodge	14,345	16,459	17,929	241,772	222,328	+ 8.6	7.41	7.30
Pontiac	12,567	13,525	12,390	200,243	150,519	+ 33.0	6.13	4.94
Buick	18,056	15,714	15,808	188,006	138,043	+ 36.2	5.75	4.53
Oldsmobile	10,349	10,547	4,460	176,657	157,234	+ 12.1	5.41	5.16
Packard	5,588	5,466	6,771	89,677	60,467	+ 48.2	2.74	1.99
Chrysler	6,598	6,835	4,723	85,182	50,780	+ 67.9	2.61	1.67
Terraplane	3,567	3,360	5,257	70,525	69,582	+ 1.2	2.16	2.28
De Soto	5,079	4,736	3,464	69,719	39,098	+ 78.1	2.13	1.28
Studebaker	4,030	4,721	5,502	65,840	60,564	+ 8.8	2.01	1.99
Nash	3,248	2,907	2,959	64,382	36,889	+ 74.3	1.97	1.21
Willys	2,453	3,035	554	48,927	11,285	+334.0	1.50	.37
La Salle	1,888	2,105	1,404	27,200	10,880	+150.0	.83	.36
Lincoln	1,404	1,321	1,655	23,059	13,359	+ 72.2	.71	.44
Hudson	1,267	808	1,421	14,366	18,761	+ 23.5	.44	.62
Graham	561	895	1,040	13,050	14,807	− 11.8	.40	.49
Cadillac	611	600	952	10,521	10,324	+ 2.0	.32	.34
Cord	40	49	51	1,132	1,085	+ 4.4	.03	.04
Hupmobile	120	108	.....	291	.....	.....	.01	.....
Pierce-Arrow	5	2	54	157	736	− 78.6	.01	.02
Auburn	1	1	83	146	1,791	− 91.8	.....	.06
Miscellaneous	117	120	908	1,308	9,268	− 86.0	.04	.30
Total	190,185	197,391	217,610	3,267,298	3,045,819	+ 7.1	100.00	100.00
Chrysler Corp.	52,147	51,870	67,772	831,437	760,744	+ 9.4	25.45	24.98
Ford and Lincoln	16,475	36,349	28,715	750,407	691,928	+ 8.2	22.97	22.72
General Motors	100,566	87,700	96,523	1,315,653	1,307,912	+ 0.8	40.27	42.94
All Others	20,997	21,472	24,600	369,801	285,235	+ 29.8	11.31	9.36

* Does not include returns of Wisconsin since June, 1937. All data are on a comparable basis.

. . . slants

ANTI-ICING PAINT — *Impressive results are claimed for an anti-icing compound known as "Killfrost" painted on aircraft wings, control surfaces, and propellers in tests conducted with the cooperation of Imperial Airways. As reported by the American Consulate General, London, the compound was painted on appropriate surfaces of the flying boat*



THE JOB Over 20 separate stampings are welded into the unit-type, all-steel underbody for Packard Eight and Six bodies. The assembly requires three welding machine operations with a total of approximately 600 spot welds. A description of the equipment and operations involved appears on this page.

THE MACHINE An inside view of the working table of one of the first two Progressive Hydromatic spot welders on the Packard underbody assembly line. Over 250 individual welding guns are exposed to view. (See article on this page "New Welding Line At Packard.")

"Cambria" and remained in sufficient quantity to prevent ice formation while the ship was flown through a two-hour blinding rain during a recent Atlantic crossing. About 30 *lb. of the material are required for one application on an Imperial Airways' flying boat. It costs approximately* $11.20 *per lb.*

Philco Laboratory to Detroit

Philco Radio and Television Corp. has moved its automobile radio engineering laboratories from Philadelphia to Detroit, the shift taking place Jan. 1.

The move was made, according to company officials, to place the Philco research engineering staff in close propinquity to the motor vehicle plants in and about Detroit, for whom Philco manufactures automobile radios.

Manley Products Changes Name

The name of the Manley Products Corp., York, Pa., has been changed to The Remco Products Corp. As stated by Robert E. Manley, president, there has been no change in the management or corporate structure.

SW Agent for Laminated Shim

The Laminated Shim Co., Inc., Long Island City, N. Y., has appointed the Industrial Sales and Engineering Co., Houston, Tex., exclusive agent in the Southwest for the sale of Laminum and its other shim products.

New Welding Line at Packard

Battery of Three Progressive Hydromatic Spot Welders Permits Underbody Assembly In 1½ Minutes

A most interesting welding development is the new welding line for assembly of the unit-type, all-steel underbody for Packard Eight and Six bodies. The assembly, consisting of over 20 individual stampings, is produced in a battery of three Progressive Hydromatic spot welders providing a total of over 600 spots for each assembled underbody.

Due to the cumbersome nature of a completed underbody, the decision was made to use the three welders in tandem. The arrangement not only conserved productive floor space but eliminated much of the materials handling problem. With the set-up, it is possible to completely assemble the underbody in about 1½ min.

Sequence of operations is as follows: The first step is to load all brackets and bracing strips in proper position for welding onto the underside of the forward panel major stamping while the carriage is in the raised or loading position. Two operators load the panel. The moveable carriage then comes down, exerts approximately 20-tons hydraulic pressure, and the welding cycle is started. Guns are indexed in series of 12.

The first machine in the series produces about 228 spots, the entire welding cycle being completed in approximately 21 sec. of actual welding time. The carriage raises again by means of four large hydraulic cylinders, one on each corner of the machine, and locks in a positive safety position. Reindexing for the next unit is completed while the carriage is rising.

Because of closeness of spacing as well as the multiplicity of spots required for the forward part of the underbody, the second machine in the series is an exact duplicate of the first except that it welds approximately 222 spots in alternate locations. In both cases, the machines have three complete welding units utilizing six 150 KVA transformers each.

Following the completion of 450 spot welds on the first two machines, the forward panel of the underbody then is slid forward to the third machine for overlapping and joining to the rear panel major stamping with its brackets and other parts.

A feature of the new machines is the use of the patented Progressive Cableless Hydromatic welding guns. This constitutes a great improvement over the previous machines by eliminating individual shunts, cables, bus bar supports, etc. Hydraulic power is supplied by an Oilgear unit mounted externally where it may be readily serviced. Welding timing and control operation for each machine is afforded by the installation of three Allen-Bradley repeating timers, per machine. These are mounted in the columns of each machine.

Business in Brief

Written by the Guaranty Trust Co., New York

There was no reversal of the downward trend of business activity during the holiday week. The index compiled by the *Journal of Commerce* registered another sharp drop, standing at 65.7, as compared with 72.4 in the preceding week, and 92.3 a year ago. Practically all branches of industry reported declines. Retail trade was from 2 to 8 per cent above that in the corresponding week last year. The post-Christmas drop in retail sales was not so sharp as usual this year, for there was a good response to clearing events.

According to the Association of American Railroads, net railway operating income of Class 1 railroads in November was approximately 55 per cent below that in the corresponding month last year. The decline was attributed to higher expenses and lower revenues.

Freight Loadings

Railway freight loadings during the week ended Dec. 25 totaled 460,367 cars, which marks a decline of 142,925 cars below those in the preceding week, a reduction of 102,211 cars below those a year ago, and a fall of 6311 cars below those two years ago.

According to the Federal Reserve Bank of New York, sales of reporting wholesale firms in the New York district in November averaged about 12 per cent below those in the corresponding period last year. This decline marks the sharpest year-to-year decrease since March, 1933.

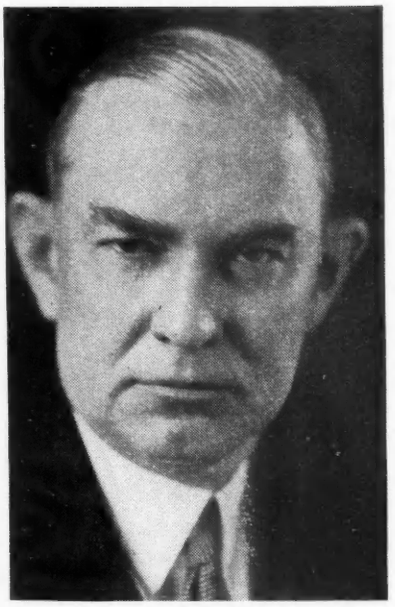
Exports and Imports

Both exports and imports declined seasonally in November. Exports during the first 11 months of this year totaled $3,026,872,000, as compared with $2,226,178,000 in the corresponding period last year. Imports aggregated $2,878,202,000, as compared with $2,177,431,000.

Lumber production during the week ended Dec. 18 stood at 41 per cent of the 1929 weekly average. Output was 9 per cent smaller than new business and 11 per cent greater than shipments.

Professor Fisher's index of wholesale commodity prices for the week ended Jan. 1 stood at 83.1, as compared with 83.2 the week before and 83.9 two weeks before.

The consolidated statement of the Federal Reserve banks for the week ended Dec. 29 showed a decline of $3,000,000 in holdings of discounted bills. Holdings of bills bought in the open market and Government securities remained unchanged. Money in circulation declined $110,000,000, and the monetary gold stock was reduced $5,000,000.



Underwood & Underwood Photo

FREDERICK WOOD

. . . New York attorney who is reported retained by the Ford Motor Co. to function in the company's impending legal appeal from the National Labor Relations Board's edict charging unfair labor practices. Mr. Wood figured prominently in the now famous Schechter Poultry Case and was subsequently credited with bringing about the death of the N.R.A.

Ford Petitions NLRB

Asks Board to Set Aside Charges; Gives Seven Reasons for Action

The National Labor Relations Board has taken under advisement the petition filed by the Ford Motor Co. asking the board to set aside and vacate the accusation that the company has violated the Wagner Act.

The board was expected to bring the case before a Circuit Court of Appeals on Monday but NLRB officials said that the step taken by the Ford Co. would forestall the filing of a petition for enforcement of its order.

Requesting that new hearings be opened in the case to ascertain the truth of charges alleged, Louis J. Colombo, Ford attorney, cited these reasons for his company's action:

1. NLRB exceeded its statutory and constitutional authority;
2. Findings of the board were unsupported by substantial evidence;
3. Facts brought out at NLRB hearings were insufficient to support the board's decision;
4. The decision and order were based upon misapprehension of the company's policy;
5. In announcing its decision, the board failed to take into account conditions existing in Michigan last May;
6. Ford workers satisfied with their jobs made proper preparations to resist the planned invasions of Ford property by the UAW to prevent a strike; and
7. The fact that only 29 out of 80,000 workers in the River Rouge plant were discharged is eloquent in itself that the Ford Co. does not discriminate against union members.

Pease Co. Occupies New Plant

The C. F. Pease Co., manufacturer of blue-printing machinery, recently moved into its new plant at 2601 West Irving Park Road, Chicago.

Parts Industry Peaks

Record Employment and Pay for Original Equipment Division

During 1937 more men were at work and earned more money for each hour of labor in the original equipment division of the automotive parts industry than ever before. Despite first quarter shutdowns in the industry, 14.8 per cent more manhours were worked than in the year 1936; 31.4 per cent more than in 1935, and 57.3 per cent more than 1934.

Employment rose to an all-time high with 26.8 per cent more persons working than in 1929; 20.7 per cent more than 1936; 31.4 per cent more than in 1935, and 44 per cent more than in 1934.

Average hourly rate of pay for all factory employes was 14.5 per cent greater than 1929 with an increase of 17.9 per cent over 1936; 22.0 per cent over 1935, and 33.4 per cent over 1934, and yearly earnings for each factory employe were up 12.1 per cent over 1936; 21.9 per cent over 1935; 45.7 per cent over 1934.

During 1937, the 48 plants used as an index of this division paid out a total of $131,098,000, 34.8 per cent more money than in 1936; 59.9 per cent more than in 1935, and 107.7 per cent more than in 1934.

Automotive News from Tokyo

Japanese Considering Further Curbs on Exports As China War Increases Home Demand

Dispatches from AUTOMOTIVE INDUSTRIES' Tokyo correspondent indicate that the Japanese government is considering stringent restrictions on exportation of automobiles and parts because of increased home demand stimulated by the war in China. An ordinance covering larger types of cars and related parts has already been promulgated in the Official Gazette. Export of tungsten also has been prohibited. Although Japan does not produce much of this metal from domestic ores, large quantities of tungsten ores are shipped from China to Japan for refining.

New Automobile Plants

In an effort to obtain a government charter under the provisions of the Automobile Industry Control Law, the Tokyo Jidosha Kogyo, is rushing construction of two plants, one at Tsurumi, the other at Yokohama. The firm was organized last summer with the merger of the Jidosha Kogyo K.K. and the Toyko Gas and Electric Engineering Co., Ltd.

Upon completion of the plants the firm will be capable of turning out 3000 units per year, the minimum capacity required by law. It is further reported that the Jidosha Kogyo is planning to establish a research institute at Omori, near Tokyo.

Although the Nissan Jidosha Kaisha, Ltd., was supposed to forfeit its privilege as a licensed motorcar manufacturer with the removal of its head office to Manchukuo, this has been avoided by transferring the greater part of the Nissan shares to the Hitachi Works, Ltd., and the Dai-ichi Life Insurance Co. Through this arrangement, the controlling interest in the firm remains in the hands of Japanese corporations.

New Firms

The Manchuria Sangyo Koshi (Industrial Company), now being organized by the Nissan interests, will start its activities on the continent by buying up the shares of the Dowa Automobile Co., which are now jointly held by the South Manchuria Railway Co. and the Manchukuo Government. The Dowa Automobile Co., thus placed under the management of Gisuke Aikawa's Nissan concern, will considerably extend its scope of operations.

Preparations are now being made by a section of Japanese automobile manufacturing interests for establishing a new firm exclusively engaged in manufacture of automobile parts and accessories at the capitalization of 2,000,000 yen.

The firm will be incorporated

(Turn to page 43, please)

PUBLICITY An effective Japanese poster issued by the Department of Commerce and Industry, Tokyo, to stimulate public interest in an automobile show held recently.

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

Minor Mention

On Nov. 9 Arthur L. Clough delivered a discourse on motor carriages before the Manchester (N.H.) Board of Trade. For the present Mr. Clough was inclined to favor the gasoline motor; although he thought that when charging facilities were common the electric vehicle would have the preference.

E. H. Lyon, who recently purchased a Duryea wagon, is very well pleased with his purchase. He has used it for several months in the neighborhood of his home, at Englewood, N. J., where the hills are steep, yet he has always found it easy to leave horses panting in the rear.

From *The Horseless Age*, October, 1897.

Total New Truck Registrations* Show 3% Gain

New truck registrations for November, 1937, slid down approximately 31.7 per cent as compared with the 39,433 units marked up for the previous month. November's total as compared with the same month's total in 1936 decreased about 9 per cent. A slight increase is revealed in the first 11 months' totals for 1937 as compared with totals for the same period in 1936 amounting to 3 per cent.

	November 1937	October 1937	November 1936	ELEVEN MONTHS 1937	ELEVEN MONTHS 1936	Per Cent Change, 11 Mos., 1937 over 1936	Per Cent of Total Eleven Months 1937	Per Cent of Total Eleven Months 1936
Ford	4,508	10,103	5,050	179,475	163,386	+ 10.0	30.96	29.04
Chevrolet	8,191	10,511	9,925	170,892	187,403	− 8.9	29.48	33.31
International	4,948	6,367	4,773	70,987	65,525	+ 8.1	12.25	11.65
Dodge	3,807	5,042	5,218	59,824	79,936	− 25.1	10.32	14.21
G. M. C.	2,281	3,165	1,241	40,993	24,764	+ 65.5	7.07	4.40
Plymouth	711	950	40	12,723	2,346	+443.0	2.19	.42
Diamond T	383	474	663	7,608	7,799	− 2.5	1.31	1.39
White	406	566	534	5,583	5,284	+ 5.8	.96	.94
Mack	342	432	396	5,163	3,766	+ 37.0	.89	.67
Studebaker	179	261	199	4,883	3,026	+ 61.0	.84	.54
Terraplane	151	261	74	4,658	1,710	+172.0	.80	.30
Reo	192	275	247	3,916	3,880	+ 1.0	.68	.69
Federal	121	163	228	2,228	2,664	− 16.4	.38	.47
Autocar	149	194	180	2,024	1,283	+ 57.9	.35	.23
Brockway	119	129	134	1,491	1,590	− 6.1	.26	.28
Indiana	74	91	115	1,307	1,548	− 15.6	.23	.27
Stewart	66	79	98	1,088	1,186	− 8.5	.19	.21
Divco	43	96	71	1,087	910	+ 19.2	.19	.16
Willys-Overland	80	55	162	929	2,294	− 59.5	.16	.41
Stutz-Pak-Age Car	15	30	.....	575	.....	.....	.10	.....
F. W. D.	28	42	28	408	288	+ 41.7	.07	.05
Sterling	14	20	34	299	240	+ 24.6	.05	.04
Kenworth	5	21	.....	127	.....	.....	.02	.....
Schacht	.....	.....	.....	40	.....	.....	.01	.....
Miscellaneous	111	106	201	1,377	1,817	− 24.2	.24	.32
Total	26,924	39,433	29,611	579,685	562,645	+ 3.0	100.00	100.00

* Does not include returns of Wisconsin since June, but all data are on comparable basis.

Automotive Metal Markets

Forecast of Gradual Improvement in Steel Demand Encouraged by Upturn in Scheduled Operations

Step-by-step improvement in demand was generally forecast in the steel market this week. Microscopic as was the gain in the American Iron & Steel Institute's estimate of employed ingot capacity, which was reported at 25.6 per cent of capacity for six days, as compared with last week's 19.2 per cent for five days, it was the first increase in scheduled operations in four months and hope ran high that it marked the turn for the better.

During the second half of January orders and specifications are expected to come in somewhat more freely. Inventories and profit and loss statements will then be out of the way. Majority sentiment in the steel industry inclines, however, to the view that the upturn will be emphatically gradual and, conditions being what they are, producers would rather have it so than sudden bulges with the inevitable dips in their wake.

The subject of steel prices continues to be one of academic discussion, no business, that would bring about a representative test, so far overhanging the market. About all that can be said definitely, is that, if any reduction in the selling price of automobiles should ensue, adjustment of flat steel prices would become an immediate problem. Meanwhile talk of pressure being brought by this or that automobile manufacturer for lower steel prices meets with denials in responsible quarters.

Interpretation of the figures released by the Automobile Manufacturers Association on 1937 steel consumption in automobile manufacture, which is reported at 18 per cent of the total steel output, compared with 22 per cent in the preceding year, when approximately 10 per cent fewer cars and trucks were made, points out, of course, as the chief explanation the lighter per unit steel content of 1937 models. When it comes to measuring the support given to the steel industry by automobile manufacturers, it may be well to recall that, aside from the steel contained in each finished unit, they buy much steel that is not seen in the assembled car. There is the steel for dies for one thing, and the steel that goes into machine tools. Many forming and stamping operations necessitate the purchase of steel that does not show up in the finished parts, but that finds its way to the scrap pile in the form of borings, clippings and turnings, making up in the aggregate a neat slice of the automotive industry's steel bill. Moreover, a good deal of pig iron, made by steel companies, also finds its way into automotive foundries and, although not steel, forms part of the picture of the automobile industry's importance as a metal buyer, to say nothing of its prominence as a buyer of structural steel for plant additions. And the cost of the finished steel contained in automobiles, in dollars and cents, makes up a much larger part of the steel industry's billings than is indicated by 18 per cent consumption of the tonnage output.

With liquidation of prices in the non-ferrous metal markets having apparently run its course, producers and importers waited for some fillip to overcome the market's lethargy. A mild rise in sterling exchange at the beginning of the week came in for minor attention in the tin market, which was under the influence of statistics, showing the world's visible supply at the beginning of 1938 to be the largest in four years—exceeding 27,000 tons. Spot Straits opened the year at 41⅛ cents, ⅛ of a cent above the 1937 close. On Tuesday the market rose to 41⅝ cents in response to fractional advances in London and Singapore.

Copper showed a fairly steady tone. The "export" price rose to 9.95 cents on Tuesday and in the home market bookings were uniformly at 10⅛ cents.

The white metals were quiet, but developed a somewhat firmer undertone.—W. C. H.

Tractor Exports Move Ahead 145%

November '37 Sales Total $1,559,777 With Heaviest Increase in 15-32 Belt Hp. Class

Figures for November, 1937, show that exports of wheel tractors, valued at $1,559,777, surpassed those for November, 1936, valued at $595,448, by 145 per cent, according to the machinery division, Department of Commerce. There was a decided upswing in the sale of all three types of tractors, the most noticeable being in the 15 to 32 belt hp. class, which showed a gain in value from $361,556 to $944,561. Foreign sales of tractors and parts during November, 1937, valued at $3,274,991, is an 84 per cent gain over the corresponding period of 1936, when the figure stood at $1,775,429.

Foreign sales of tracklaying tractors in November, valued at $1,073,886, advanced 31 per cent over the comparable period in 1936, valued at $818,822 and, as was the case in October, the greatest increase in this class was made in the fuel injection type when an advance from $408,395 to $672,975 was made. There was a slight decline in the exports of tracklaying tractors of carburetor type in the classes under 35 drawbar hp., and 60 and over drawbar hp., although substantial gains were made in all other types classified under tracklaying tractors. Sales of the fuel injection type under 35 drawbar hp. advanced from $17,697 to $76,740; 35 to 59 drawbar hp., $203,758 to $337,102; 60 and over drawbar hp., $186,940 to $259,133.

Export shipments of engines for tractors during November, 1937, were nearly five times greater than for the corresponding month of 1936, rising from $6,015 to $28,528, explains the machinery division, while parts and accessory exports nearly doubled those of the same month in 1936. The advance in this instance was from $355,144 in November, 1936, to $612,800 in November, 1937.

GM Names New Secretary

Lisle Rhodes Beardslee, assistant secretary of General Motors Corp., has been elected secretary of the company to succeed the late Thomas S. Merrill.

A. F. Power, for 10 years associated with General Motors' legal staff, has been named to the post of assistant secretary. Mr. Power's headquarters will be in Detroit.

National Boat Show Opens

The thirty-third annual National Motor Boat Show opened Jan. 7 at Grand Central Palace, New York City, with more than 120 small sailboats and sea-going motor yachts on display.

Marine products for 1938 were shown by more than 150 exhibitors. A review of this new equipment of automotive interest will appear in an early issue of AUTOMOTIVE INDUSTRIES.

Firestone Reports

Record High Dollar Sales Volume For Fiscal Year Ended Oct. 31

Despite heavy inventory write-downs due to the sharp decline in crude rubber prices, the Firestone Tire & Rubber Co. had the largest dollar sales volume in its history and its highest net earnings since 1927, in the fiscal year which ended Oct. 31. Sales were $156,823,094 compared with $135,701,916 in 1936, a gain of 15.6 per cent. Net profits totaled $9,269,176, equivalent after preferred dividends to $3.33 a share on common stock, compared with $9,142,654 or $3.28 a share in 1936.

Reflecting the Firestone company's decentralization program which in 1937 included establishment of a new 5000 per day tire plant at Memphis, Tenn, purchase of an extensive factory property at Fall River, Mass., and the launching of a new steel products plant at Riverview, Mich., the annual report shows an increase of more than $7,000,000 in valuation of plants, real estate and equipment. These items combined were $61,451,704 at the end of 1936 and were $68,508,214 at the end of October, 1937. As result of its six weeks' Akron strike of last spring, the company discontinued manufacture of automobile storage batteries and never re-hired about 1000 men in the battery plant.

The company's bank indebtedness increased sharply during the year from $12,000,000 to $27,500,000. Current assets on Oct. 31 of last year were $88,332,892, including $10,714,036 cash. Current liabilities were $41,800,088, including the $27,500,000 in bank notes payable. On Oct. 31, 1936, current assets were $75,693,520, including $11,279,479 cash and current liabilities were $24,048,912, including $12,000,000 bank notes payable.

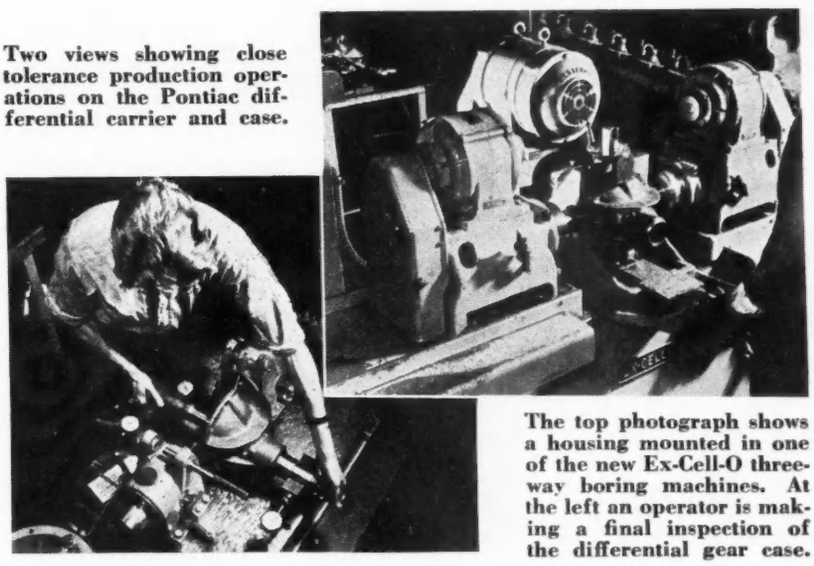
New Cotton Cord for Tires

Development of "heat resistant" cotton cord for use in heavy-duty automobile tires has been announced by William D. Anderson, president, Bibb Manufacturing Co., Macon, Ga.

Patents have been issued to three members of the textile organization, Russell B. Newton, superintendent of the Columbus, Ga., plant; E. C. Gwaltney, acting agent at Columbus; and Leon A. Craybill, chief technologist, with headquarters in Macon.

"Essential gums and waxes of the cotton fiber," a company statement said, "are fused and bonded together in the process of manufacturing."

TOOLS OF TOMORROW



Two views showing close tolerance production operations on the Pontiac differential carrier and case.

The top photograph shows a housing mounted in one of the new Ex-Cell-O three-way boring machines. At the left an operator is making a final inspection of the differential gear case.

Accuracy

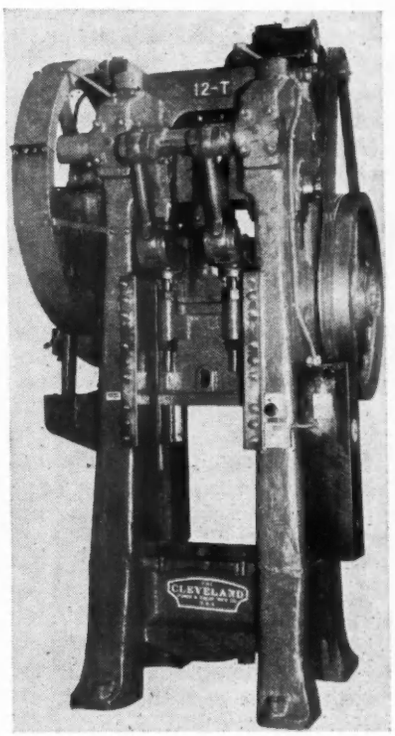
. . . Ex-Cell-O boring machines facilitate close tolerance production at Pontiac

Pontiac Motor Division of General Motors recently set up its machining operations on differential carrier and case for close tolerance production, using a new Ex-Cell-O three-way boring machine for operations on the carrier.

With the Ex-Cell-O equipment only one set-up is required for finishing the two differential carrier bearings and the pinion bore. The differential carrier is located on the machine from two drilled and reamed bolt holes and the face of the carrier. Cutting is with tungsten carbide tipped tools.

Inspection follows and specifications call for holding the pin to crossbore relationship to one thousandth above or below. In production the carriers run within 0.0002 in. for squareness in 7 in. Each bearing hole is inspected with a Swedish gage reading to 0.0001 in., with a specified tolerance of 0.0001 in.

Production with the three-way machines is reported to be at the rate of 60 carriers per hour. A feature of the machine itself is the provision of tapered plates which permit ready adjustment of the boring spindles for height in case of any wear on the machine ways. In line with the accurate machining of the differential carrier, pinion shanks are ground and lapped to size within plus or minus one tenth.



New single crank double action toggle press equipped with an electrically controlled, hydraulically operated friction clutch. The machine, made by the Cleveland Punch & Shear Works Co., Cleveland, operates at the rate of 17 strokes per minute. Other specifications include: bed area of 28 in. front to back and 26 in. right to left; 20-in. stroke of plunger with 4-in. adjustment.

AUTOMOTIVE ABSTRACTS

Four-Wheel Trailers

The subject of "snaking" of four-wheel trailers has been investigated by means of scale models at Stuttgart Technical College, and the results of the experimental work were discussed in a paper presented at a local-section meeting of the Automobile-technical Society in Chemnitz. The tests were made on a model built to a scale of 1:10, on a moving roadway with the model stationary in space. In order to check the results, the track followed by an actual trailer while "snaking" on the highway was marked by squirting a colored liquid on the pavement, and it was found that the tests on the model gave an accurate picture of the behavior of the trailer on the road.

It was found that there are a number of factors which promote "snaking" of trailers, including lash in the steering gear of the trailer, insufficient lateral stability or rigidity of trailer tires, a short wheelbase, a short drawbar, small draft on drawbar, over-running of the trailer, large lateral motion of the coupling (as, for instance, when it is located far behind the rear axle of the tractor), and excessive friction in the steering gear. Less important factors are the method of wheel suspension and the load distribution between axles. It is true that if there is an excessive load on the front axle of the trailer the "snaking" tendency is increased.

"Snaking" is reduced by a long wheelbase, a long drawbar, restricted lateral motion of the coupling, and braking on the trailer alone (but only within the non-locking range). A high center of gravity tends to induce rolling of the body, and if this rolling action happens to be in resonance with the snaking motion, the stability of the vehicle is endangered. A transverse stabilizer may prove helpful under certain conditions.

An effective means for the suppression of snaking is damping of the motion of the drawbar around the coupling pin, combined with a stiffening of the trailer connection against buckling of the steering gear on overrunning. Another measure against "snaking," applicable where fifth-wheel steering is used, consists in locating the axis of the fifth wheel ahead of the front axle, but this is inconvenient from the manufacturing standpoint. Recent tests have shown that one-way springing of the steering mechanism disturbs the action of the oscillating system, without, however, attaining the effectiveness of a damped draft gear.

After a "snaking" motion has been once induced, it is favored by smooth roads. Very rough road surfaces, which cause short bouncing motions of the wheels, interfere with continued excitation of the snaking motion. On turns the snaking motion is being damped by the centrifugal force.—*ATZ*, Dec. 10.

Objective Noise Meter

An objective noise meter has been designed at the National Physical Laboratory (England). Long experience has led the sound division of the Physics Department to the conclusion that the loudness of certain sounds, such as traffic noises, cannot be measured with sufficient precision by secondary noise meters of the subjective type, in which a standard sound of adjustable loudness is produced in a telephone head piece and matched against the noise under observation. Even if a large group of trained observers are used, the results are not satisfactorily consistent, and it has become increasingly evident that what is required is an objective meter which indicates aural loudness by the reading of an electric indicator.

The new noise meter of the National Physical Laboratory consists of a microphone, an amplifier, and an output meter, and its response to pure notes of constant frequency has been adjusted to agree with aural judgments over a range of moderate loudness levels. The circuits have been so designed that the meter indicates correctly the equivalent loudness of intermittent and impulsive noises. The new meter has been thoroughly tested with a great variety of sounds. Equivalent loudnesses of these sounds were simultaneously determined separately by the primary subjective method in terms of the standard British phon.

In the specially important case of motor-car noises the sounds were transmitted to a distant room, in which the actual car was inaudible, by means of a microphone and loudspeaker assembly. The general outcome of these tests, so far as concerns fairly loud noises, is that the readings of the objective noise meter agree with the mean subjective determinations of equivalent loudness much better than the average of individual aural estimates, and that the meter is in very satisfactory agreement with the standard scale of equivalent loudness.—*Engineering*, Dec. 10.

211,772 New Pontiacs in '37

During the 12 months ending Dec. 31, Pontiac dealers in the United States delivered 211,772 new cars and 393,700 used cars, an appreciable increase as compared with 178,931 new and 327,842 used cars sold in the calendar year of 1936. Largest previous year's sales of new cars totaled 196,096 in 1928.

A comparison of sales throughout the world by model year instead of by calendar year shows sales of 1937 model Pontiacs totaled 236,189, while in 1936 they were 173,137.

In 1936, Pontiac registered 5.7 per cent of the business nationally except that in the high price brackets. In 1937 the percentage increased month by month with 8.12 per cent of the business in October and 8.24 per cent in November, giving a national figure for the year 1937 of 7.05, highest in Pontiac's history.

Accurate Parts Mfg. Co., Cleveland, Ohio, has issued a revised edition of its brochure on **Clutches**—How to Service Them. Copies are available at 50 cents each.

Booklet No. 106 recently issued by the Niagara Machine & Tool Works, Buffalo, N. Y., gives a compact presentation of the complete line of Niagara **presses, shears** and machines for shearing, blanking, drawing and forming sheet and plate metal.

Latest publication brought out by the Machinery and Allied Products Institute, Chicago, is titled **"Savings and American Progress."** It presents discussion of the relation of wealth-creating enterprise to employment and the American standard of living.

"Legibility plus Precision" is the name of a new folder prepared by The Brown Instrument Co., Philadelphia, Pa.*

Metropolitan Life Insurance Co., policyholders service bureau, has completed a

study of the organization and functions of the personnel departments and has published a report of the findings, **"Functions of the Personnel Director."***

A new edition of bulletin No. 910 describing its line of **separator magnets** has been issued by The Electric Controller & Mfg. Co., Cleveland, Ohio.*

A catalog on the Brown **automatic boiler regulation system** has been published by The Brown Instrument Co., Philadelphia, Pa.*

A brochure on industrial and commercial applications of **glass** has been published by the United States Glass Co., Pittsburgh, Pa.*

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Buick Cracks Record

1937 Output of 233,923 Units Largest in 10 Years

World production of Buick cars in December totaled 18,360, bringing 1937 output to 233,923 units, largest volume in 10 years, according to H. H. Curtice, president. This latter figure compared with 184,255 cars built in 1936, represents an increase of 49,668 units or 26.9 per cent. Including estimated deliveries for the last 10 days of December, domestic sales volume for the year amounts to 203,739 cars against 164,861 in 1936.

Exports in 1937 reached a new high of 22,106 cars. For the preceding year this figure stood at 16,152.

Buick rose to third place in domestic sales with 18,056 units during November, and sales for the first 20 days of December indicate that this position was maintained in the final month. Volume in the fourth quarter approximated that of a year ago. December sales in the domestic market were estimated at 14,000 units, while export shipments totaled 1819.

Buick's 1937 payroll in Flint totaled $32,000,000. This is an increase of more than $6,400,000 over last year and places the monthly average at $2,600,000. The payroll was distributed to 16,399 employes, the average number on the Buick rolls throughout the year; 2500 more men than were on the rolls in 1936. Since 1934 the total payroll has increased 95 per cent, while average employment increased 43.8 per cent, reflecting not only higher wage scales, but also steadier employment with greater individual income.

Sears and Ward Cut Tire Prices

Drastic and wholly unexpected tire and tube price reductions announced by the leading mail-order houses in their mid-winter "Flyer" catalogs just off the press, will not be followed by the tire industry, according to leading manufacturers. On the contrary, independent manufacturers expect their price stabilization program, which has averted serious price warring for more than two years, to withstand the impact of the catalog price slashing without any serious break in the retail price structure throughout the country.

While the mail-order houses have reduced prices on tires and tubes sold via mail-order, they have not altered prices in their several hundred retail stores, and are not expected to do so. Informed sources point out that the volume of tire business done by mail-order has declined to a point where it represents a minor part of the total tire sales of Sears-Roebuck & Co. and Montgomery Ward & Co., the rapid expansion in retail store operations of these two companies having heavily reduced their mail-order tire sales.

Bendix Organizes Regional Areas

The Bendix Sales service division has been divided into four regional areas, eastern, central, Pacific and southern, according to O. C. Holaday, sales manager.

F. H. Kroeger, who will head the eastern division, was promoted from his zone managership for Bendix Products Corp. in New York. R. F. Davis will succeed Mr. Kroeger.

Samuel V. Harding will manage the central division. His office will be in South Bend.

Daniel B. Webster, has been promoted from the post of Bendix zone manager of the Atlanta area to the managership of the southern region, with new headquarters at Atlanta. Charles S. Leonard is his successor.

The Pacific region will be in charge of S. F. Dupree, Jr., formerly manager of the automotive sales for Bendix Aviation Corp., Ltd., Calif. His headquarters will be in Los Angeles.

D. E. Rice, assistant sales manager, will have direct supervision over all regional men.

Calendar of Coming Events

Foreign Shows

Leipzig, Trade Fair,
March 6 to 14, 1938

Conventions and Meetings

American Engineering Council, Annual Meeting, Washington, D. C. .....Jan. 13-15, 1938

SAE Annual Meeting, Detroit, Jan. 10-14, 1938

American Road Builders' Association, Cleveland, Jan. 17-21, 1938

American Society for Testing Materials, Spring Regional Meeting, Rochester, N. Y. March 7, 1938

SAE National Aeronautic Meeting, Washington, D. C. March 10-11, 1938

SAE National Passenger Car Meeting, Detroit, March 28-30, 1938

News From Tokyo

(Continued from page 39)

under the title of the Showa Automobile Engineering Co., and its plants will be constructed in Niigata Prefecture in the Northern part of Japan.

Aircraft

An increasing number of Japanese government officials in charge of the nation's aeronautical affairs are in favor of making the proposed aeronautical research institute an all-embracing enterprise. Authorities of the Navy, War, and Communications ministries are now speeding arrangements for a department to be established for the purpose of assisting in the development of aircraft designs.

It is claimed that Britain, America, France, Germany, Italy, and Soviet Russia have of late been tending to refuse shipments to Japan of precision machines and instruments for aircraft manufacture or to divulge the technique of their construction. For this reason, it is being urged that the proposed research institute should be well equipped for research and development in this particular field.

Postscripts

Much interest has been aroused in Japanese quarters by information that a German firm has offered to transfer to a Japanese firm the right to manufacture a new spark plug just introduced by the German maker.

Tokyo bus-line operators have decided to remodel their buses for the use of charcoal gas in order to conserve gasoline. If Tokyo's 2688 buses are remodeled to use charcoal gas, gasoline savings will amount to about 26,880 gal. per day, as the daily average consumption of a bus is approximately 10 gal.

Highways Must Pace Wider Automobile Sales

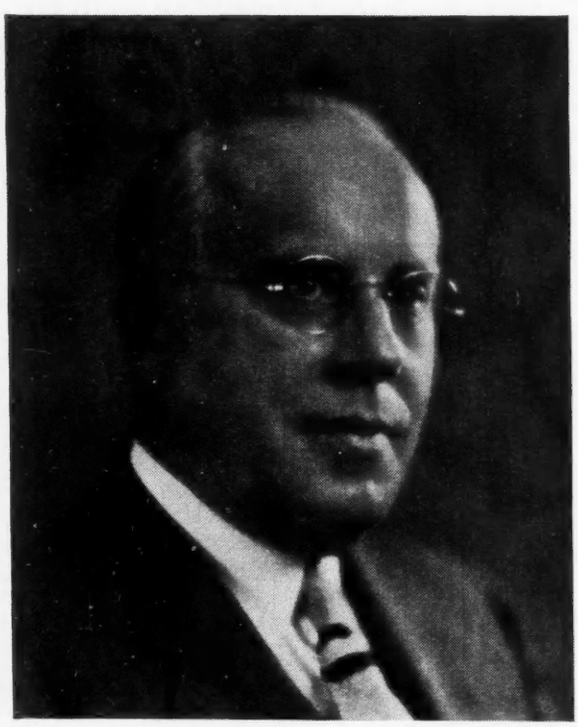
By E. J. KULAS

THERE are enough automobiles in the United States today to take every man, woman and child in the country for a ride at one time. If lined up bumper to bumper this string of cars would extend around the world three times.

There is probably no other mechanical product of our modern industrial civilization that we Americans are more proud of than our automobiles—and justly so. They are by far the finest, fastest, most convenient, most comfortable and, all things considered, the most economical transportation conveyances ever built.

But automobiles are only one-half a motor vehicle transportation system. The roads and highways are the other half. And the roads and highways, the tracks automobiles travel over, are just as vital as the automobiles themselves. Yet the highway half of our motor vehicle transportation system is so entirely inferior to the automobile half that it fails almost completely to meet the needs of the day. While tremendous improvement has been made in the development of the automobile, only a beginning has been made in providing an adequate highway system. And the great gap between automobile performance and highway need is getting wider and wider.

This gap between automobile performance and highway need we call traffic congestion. It is a very tangible yet immeasurable quantity. We cannot prove with specific figures exactly how serious traffic congestion is, nor can we make any exact comparison of traffic conditions today with traffic conditions of a few years ago. Hundreds of thousands of motorists who drive to work and park their cars in downtown business districts, and the millions of folks who wait all week for a pleasant Sunday drive in the country don't have to be shown with figures that traffic conditions are bad or are getting worse.



The author, E. J. Kulas, president of The Otis Steel Co.

But we can get some indication of the trend, at least, and the seriousness of the traffic problem by looking at some of the figures that are available. Let us compare latest complete figures with those of the year 1929, the pre-depression high. Over 5,600,000 passenger cars and motor trucks were sold in that one year, the all-time record. Let us see what has happened since that time.

Since 1929, despite the depression, the total number of motor cars, that is the total number of trucks and buses and passenger cars of every type, on U. S. highways has increased from 26,500,000 to 29,000,000 units. These 2,500,000 additional automobiles and trucks represent an increase of about 10 per

Ewing-Galloway Photos

Most of our roads are nothing more than widened Indian trails and leveled out horse and buggy roads. America needs and could use from five to ten million more automobiles than are in use today if the country had an efficient highway system to use them.

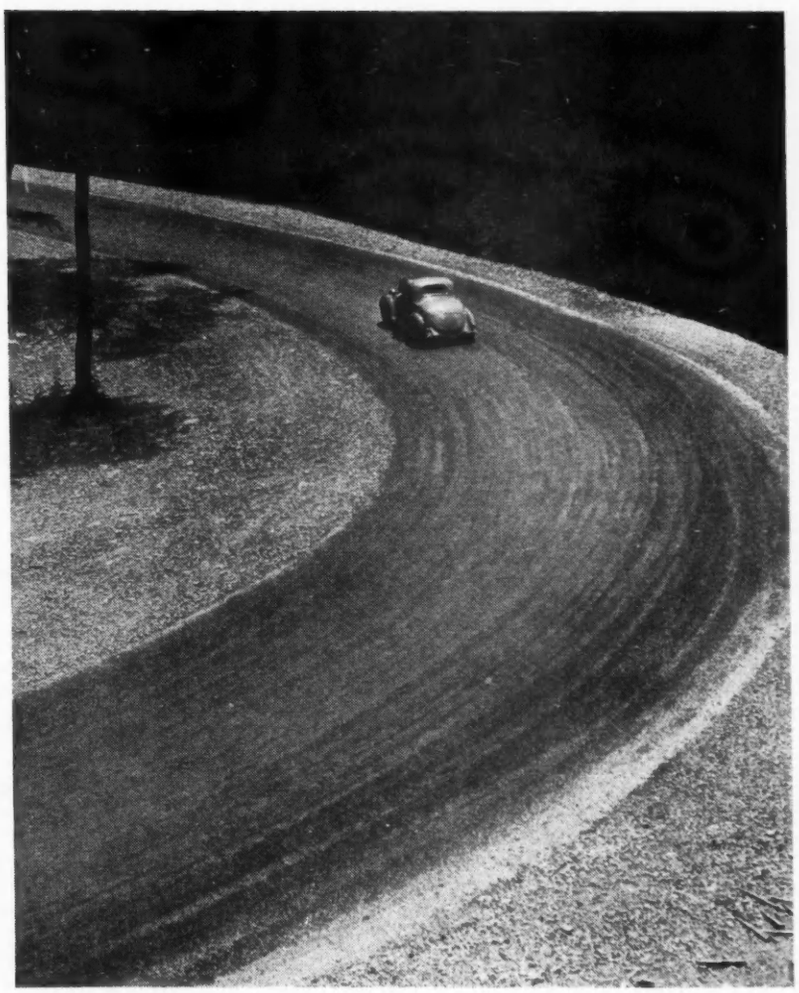
out the country in that year, a definite indication that most of the depression cars of ancient vintage are now gone.

If there is still any doubt that traffic congestion is getting worse and worse, let us look at the records of the National Safety Council. Deaths from automobile accidents are up more than 21 per cent over 1929, the year in which the slaughter of 31,215 people on streets and

cent. Of this 2,500,000 increase, well over 1,000,000 units were trucks, for while the total number of automobiles and trucks was increased 10 per cent the number of trucks alone increased from 3,380,000 to 4,400,000, which is 30 per cent. It is interesting to note here, too, though they represent less than half of one per cent of all the motor vehicles in the country, that the number of buses on the road increased from 81,000 to 121,000, almost 50 per cent.

Since 1929, the total consumption of gasoline for motor vehicle purposes increased from 12.2 billion to 17.7 billion gallons, which means that the average car today is being used 35 per cent more than its 1929 predecessor.

Figures show also that almost as many new cars were sold since 1929 as there were altogether through-



Only 113,695 miles of our primary highways have a stable base and many of these roads are just a series of dangerous curves never designed for today's high-speed traffic.

Ewing-Galloway Photos

Traffic engineers claim that they could eliminate 90 per cent of the accidents and congestion. The approach to the George Washington Bridge, between New York and New Jersey, with its by-passes and scientific planning relieves congestion and allows a steady flow of traffic in and out of New York City.

highways startled the country into doing something about the problem. Last year 105,000 were permanently disabled and 1,200,000 others were hurt temporarily in 6,500,000 traffic accidents. There are 12 accidents and two injuries every minute and a death every 13 minutes.

Yes, with the tremendous increase in the number of cars on the road, especially trucks and buses that are always a traffic hazard, with the tremendous increase in the use of each car, and with the almost complete replacement of old automobiles with fast new ones that travel with ease 70 and 80 miles an hour, the unbalanced condition of tremendously improved motor cars on a completely inadequate highway system is fast approaching a crisis.

The possibility of our soon reaching a saturation point in the number of cars in the United States, because of an inadequate highway system, is no small threat. Dr. Miller McClintock, director of Harvard's Bureau for Street Traffic Research and the country's leading traffic engineer, says, "America needs and could buy from five to ten million more automobiles than are in use today if the country had an efficient street system for using them."

The 3,000,000-mile American highway system was never designed to carry the heavy high-speed traffic it is being asked to carry today. Most of our roads, if we trace their history, are nothing more than widened Indian trails and leveled out horse-and-buggy roads. Most of our present highways were originally designed when 30 miles an hour was thought to be the limit for any future auto speed.

More than 2,000,000 miles of our 3,000,000-mile highway system are still unsurfaced mud roads. The 1,000,000 miles of surfaced roads are for the most part gravel, and many miles, improved years ago and carried on the records as improved, are actually obsolete today. According to the latest report of the U. S. Bureau of Public Roads, only 113,695 miles of our primary highway system have a stable base and a high type surface such as concrete, bituminous macadam and brick. And most of these roads, especially in the east, are just a series of dangerous curves and sharp up-and-down hills never designed for today's high-speed traffic. Less than 8000 miles of primary highway in the entire United States are more than two lanes wide. And less than 100 miles are so lighted that poor visibility could not be a factor in night accidents.

Highway engineers and traffic experts say that if they could apply all they know about improving traffic conditions, they could eliminate congestion almost entirely, and 90 per cent of the accidents. They prescribe new cross-country super trunk lines, general widening, leveling, and straightening of existing roads, separation of opposing traffic lanes on high-speed highways and elimination of railroad crossings. They prescribe the construction of by-pass highways around congested areas and arterial routes for direct access to the centers of cities. They prescribe the scientific redesigning of principal city thoroughfares, scientific traffic routing, construction of elevated highways and intelligent control of parking to alleviate intra-city congestion, the source of our most serious traffic problem.

Highway and traffic engineers know how to build the roads and structures that will solve our traffic problems. We just have to drive over any of their modern highway improvements to realize that these

Highway and traffic engineers know how to build the roads that will solve our traffic problems. This layout with a dividing island down the middle separating opposing streams of traffic is a typical example of what expert engineers can do when they are given the chance.

experts have successfully blueprinted the way.

New Jersey's 54-mile superhighway from Trenton to the Holland Tunnel with a dividing island down the middle separating opposing streams of traffic is a typical example of what can be done by expert engineers when they are given the chance. Chicago's recently completed by-pass boulevard built on filled land along the lakefront is another example. So, too, is the new Westchester Parkway from New York to Albany, one of the country's most beautiful motorways with right-of-way 500 feet wide.

And there are many other examples throughout the nation. There is the 25-mile divided express highway from Baltimore to Havre de Grace on the Philadelphia road, with reduced grades and easy curves—a complete relocation of old U. S. Route 40 which eliminated 41 of the 51 curves and which reduced the number of buildings on the right-of-way by more than 50 per cent.

There is the modernization, now nearing completion, of U. S. Route 16 between Lansing and Detroit—an 85-mile highway that originally followed the old Indian trail across Michigan—which will be a minimum of three lanes wide for the entire distance, with long straight stretches, improved grades and flattened curves.

There is the complete repaving, widening and leveling of Dodge Street in Omaha, a main city thoroughfare which bottlenecked traffic on U. S. Route 30-S, a highway that extends entirely across the State of Nebraska.

There is the beautiful Northboro cloverleaf on the Boston-Worcester Turnpike in Massachusetts; the eight-lane Pacific Highway entrance down Aurora Avenue, the heaviest traveled street in Seattle; the divided thoroughfare and traffic ovals now being built in Tucson, Arizona, first divided highway in the West; the divided lane by-pass of New York State Route 5 around the main business section of Utica; the widening, despite all sorts of difficult physical limitations, of Woodward Avenue in Detroit—all typical examples of advanced highway engineering.

New York's success with the Riverside Drive improvements down the west side of Manhattan, the four and one-half-mile Henry Hudson Parkway that relieves one of the worst traffic bottlenecks in the city at the Broadway crossing of the Harlem River, and that very last word in automobile roadway development, the Grand Central Parkway, on which humans behind steering wheels just can't get into any but the freakiest of accidents, is probably the most excellent demonstration of what can be accomplished by highway engineers.

These advanced "roads-of-tomorrow" around New York City, in which human error is almost completely engineered out of existence, are called "limited" highways. Four important features of limited highways are: the elimination of intersections by passing one highway over the other and using the cloverleaf for the turns, the elimination of driveways, service stations, and unimportant side streets that provide incidental access to the highway, the separation of traffic moving in opposite directions by a dividing island in the middle of the road, and the provision of accelerating and decelerating lanes which keep to one side all slow-moving traffic and cars just entering or leaving the speedway.

Altogether less than 100 miles of this latest type limited highway have been built in this country. Costs run up to half a million dollars per mile and more, especially when the highway approaches congested metropolitan areas where it is most urgently needed. Costs of high type road development where features of the limited highway are not absolutely essential run up to $100,000 per mile, and much higher when special structures such as bridges or additional right-of-way are needed.

Cost of rebuilding our entire highway system to meet the demands of our 29,000,000 modern automobiles runs into hundreds of millions, and billions of dollars.

Hundreds of millions and billions of dollars! There, we are apt to say at first glance, is the snag. Those figures are prohibitive, fantastic. Fantastic, these figures? Yes. But prohibitive? Well, let us see. How much money is being collected from motorists for highway maintenance and development? How much money is being collected from motorists in license plate and gasoline taxes, revenue designed to make users pay for the highway half of our motor vehicle transportation system? How much money is the federal government spending for highway development in its unemployment relief program? Again let us look at the figures.

Last year alone a total of $359,783,000 was collected in the 48 states and the District of Columbia in automobile registration and license plate fees. In the same period a total of $686,631,000 was collected at the country's 197,000 filling stations in state gasoline taxes. Three states levy seven cents per gallon, and the country-wide average is about four cents per gallon. This makes a total of $1,046,414,000 collected by the states from motorists in one year alone. In the last five

years motorists have paid, supposedly for highway development and improvement, well over four and one-half billion dollars.

These figures do not include a federal gasoline tax of one cent per gallon, county and municipal gas taxes, excise taxes, sales taxes, personal property taxes and other taxes levied against automobiles which motor owners pay. The billion dollars collected last year and the four and one-half billions collected in the last five years were state registration and gasoline taxes only—revenue, to repeat, specifically designed to make users pay for the highway half of our motor vehicle transportation system.

The Federal Government's road improvement appropriations for unemployment relief in the last few years total $1,250,000,000, including $200,000,000 specially earmarked for grade crossing work.

Then why aren't we making some progress in the solution of our highway problem? With these vast sums why aren't our highways catching up to our automobiles? What hope is there for harassed Mr. Motorist whose inching, traffic-snarled trip home from work every evening is relentlessly shattering his nervous system? What hope is there for harassed Mr. Motorist whose intercity drives are all too often nothing more than a series of spurts between small towns and cities where inevitably, it seems, the streets are hopelessly bumpy and narrow?

The answer to these questions, the solution of our automobile traffic problem is found in an analysis of the expenditure of these huge sums. The problem is not one of raising additional billions but rather that of wisely spending the billions we already have to spend. And that, in the final analysis, is in the hands of Mr. Motorist, over 29,000,000 of him, who foots the bills.

In the last five years motorists have paid well over four and one-half billion dollars supposedly for highway development much of which has been diverted to other uses. Regardless of how necessary or praiseworthy they may be they should be supported from general taxes to which the motorist, as a general tax payer, contributes his share.

Sitting behind the wheel of his fine high-speed motor car, Mr. Motorist bewails the inadequacy of a highway system that won't allow him to get quickly and comfortably where he wants to go. But he doesn't do anything about it.

If he would have a highway system that would adequately accommodate his modern streamlined motor car and his motor car of tomorrow, which will be even faster, more efficient and more powerful, he must be roused to action. He must become articulate. He must demand complete overhauling of his highway development machinery for immediate, concerted action on these three fronts:

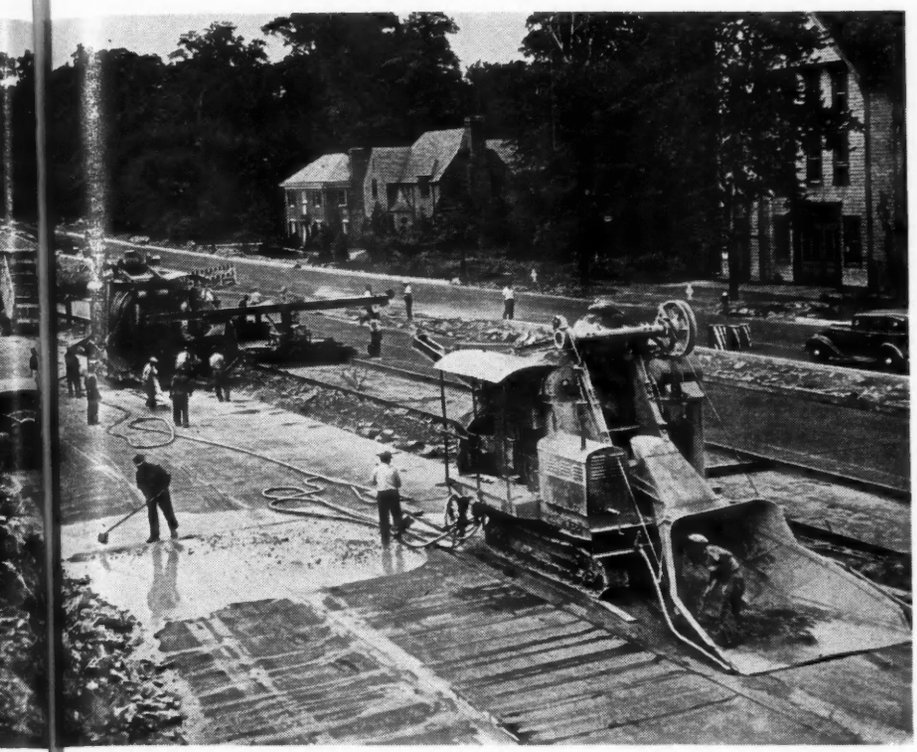
(1) Control of highway development must be centralized into the hands of one governmental unit in each state. With every county, city and township spending a share of our highway funds and with frequent changes in the personnel of these hundreds of local subdivisions, there can never be anything approaching efficient management or a balanced development of the highway network as a whole.

On almost any road, the automobile driver goes from macadam to brick to asphalt to concrete, from narrow pavement to wide pavement and back again without any rhyme or reason. The automobile owner who foots the bill has a right to expect a uniformly and consistently well designed highway system regardless of artificial local boundary lines. He travels freely from township roads to state highways and through city streets without knowing where these boundaries are.

Yet more than 25 per cent of state

Ewing-Galloway Photos

With the tremendous increase in the number of cars on the road the inadequancy of the highways system is fast approaching a crisis. It was never designed to carry the heavy high-speed traffic of today.



motor revenue goes to local political subdivisions for expenditure at their discretion. In the hands of local officials the money is spent, in all too many cases, without regard to long-range planning, without benefit of traffic experts, and without even the complete factual information needed for intelligent highway building. And "maintenance of poorly built local roads," adds Thomas H. MacDonald, Chief of the U. S. Bureau of Public Roads, "is absorbing too large a share of highway funds."

There can never even be any assurance that highway funds given local boards will be spent for highway improvement. Last year, at least two-thirds of the $265,496,000 allocated to counties, cities and towns from motor car revenues were spent without any state supervision whatsoever. This amounted to over 16 per cent of state auto tax receipts.

Moreover, though 14 states have already placed all or a large part of county and local roads under the supervision of state highway departments, none of these states has turned over to the highway departments, with the responsibility of the local roads, the full amount of funds formerly used on them.

(2) State highway departments must be put into the hands of expert engineers and highway planners above reproach. These men must be politically free and secure in their jobs, despite periodic changes in state administrations. They must be free to develop long range highway programs and to view objectively the highway problem of an entire state, without political, private interest or local community interference.

Instead of highway administrations operated on such a sound economic engineering basis, our state highway departments are almost without exception political hotbeds.

Motor revenues have been called the juiciest pork barrels ever opened. Last year in almost three-fourths of the states the gasoline tax alone produced more than any other single revenue. And in some of the other states where the gas tax did not produce the most revenue, it was topped only by income from auto license fees.

In practically every state the highway department, with thousands of jobs, provides the nucleus for the state political machine. Vast sums of motorists' money are spent on expensive highway improvements of purely local use for the currying of local political favor. Technical work is put in the hands of political favorites even though they are backward, second-rate engineers. The spoils are spread around to the host of building materials men who hound the highway department's door. And thousands of unnecessary weed-cutters, road-draggers and inspectors are employed because they never fail to show their gratitude in the precincts on election day.

(3) There must immediately be an end to the diversion of gasoline tax and license tax revenue to non-highway purposes. Last year 36 states diverted $169,344,000 of auto tax receipts (over 17 per cent of the entire state total) to non-highway uses.

Regardless of how necessary or praiseworthy these non-highway uses may be—whether it is unemployment relief, education, airports, navigation or oyster propagation as was the case in one instance—these needs are a general obligation of the state and the community as a whole. As such they should be supported from general taxes to which the motorist as a general taxpayer contributes his share. The distance a citizen travels in a motor car is certainly no just measure of the amount of taxes he should pay for any purpose other than the construction and maintenance of automobile highways.

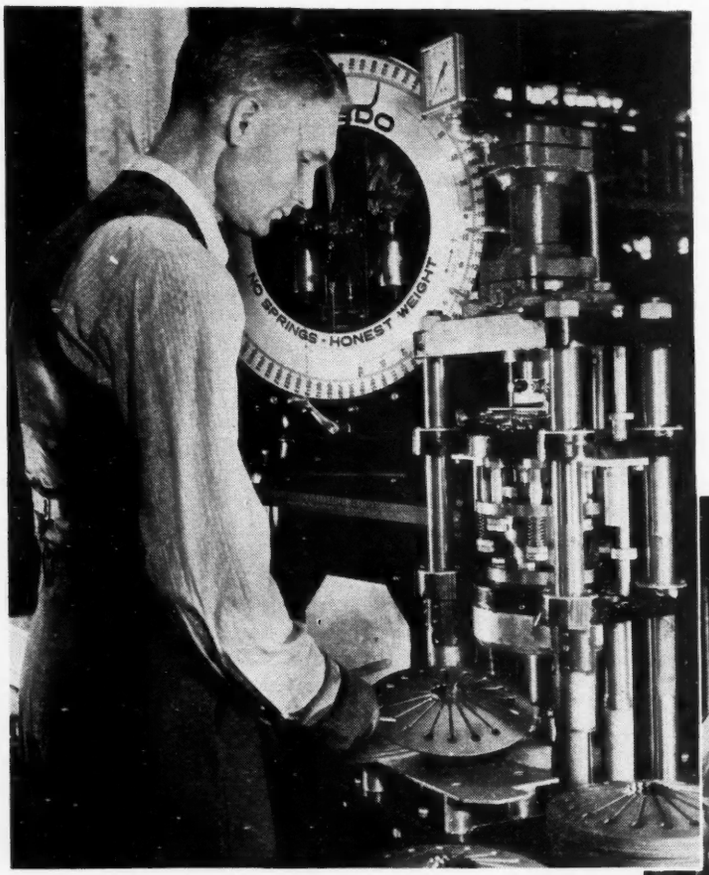
In relation to nation-wide totals, $169,000,000 may not seem to be of much consequence. But that money is of considerable importance. It represents $169,000,000 that would have been spent for new construction. The bulk of state highway revenue is spent in road repair and servicing, collection and administrative expenses, state police, highway financing and other fixed charges. Only the remainder is available for new improvements and it is out of these new improvement funds that highway revenue is diverted to non-highway uses.

Four states have already passed constitutional amendments prohibiting the use of automobile taxes for any other purposes. Other states must follow this lead. Unfortunately three states have tied up in relatively irrevocable form for non-highway purposes even future highway revenue.

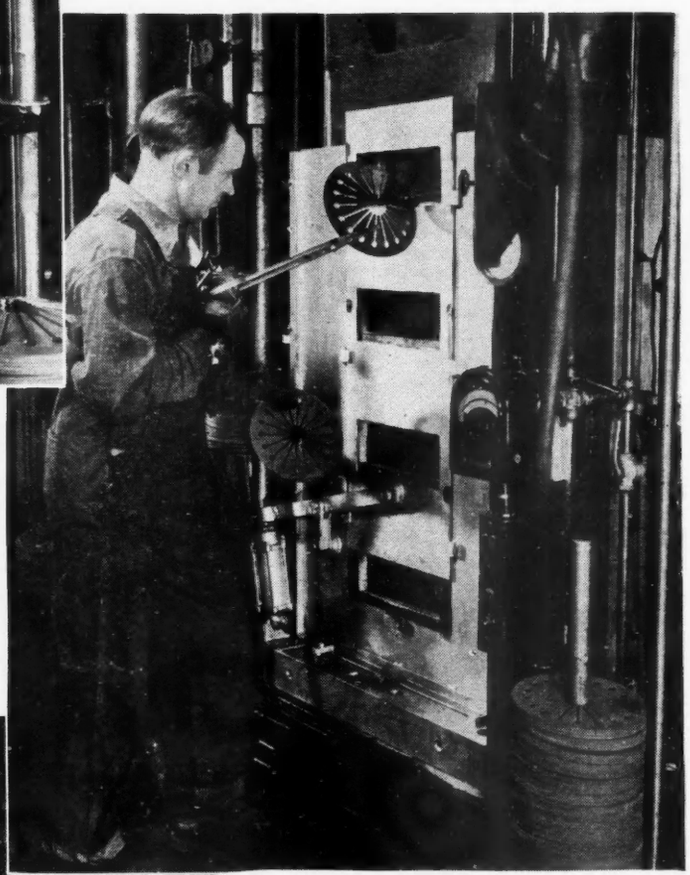
Thus we can put our finger on over $320,000,000, almost one-third of the automobile driver's annual billion-dollar payment for adequate tracks for his motor car, that is either not being spent for highway improvements at all or is being spent without any supervision of the state. How many more millions of motorists' dollars are not being spent to the motorists' best advantage, out of the $419,000,000 annual expenditure for the collection of

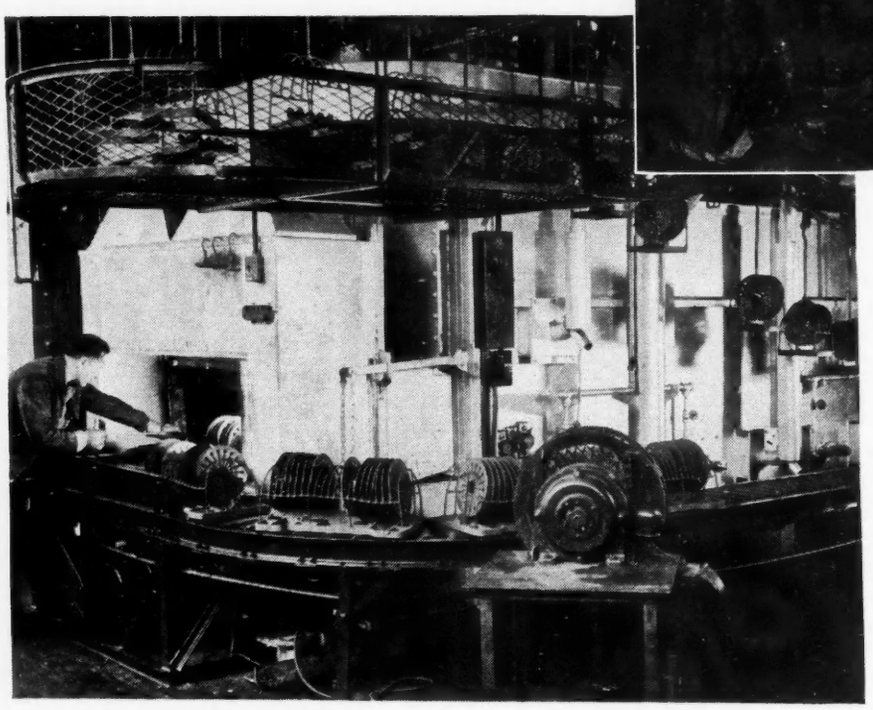
(Turn to page 60, please)

Precision



(Above): Each diaphragm spring is tested for load-carrying capacity on this special Toledo scale set-up. In taking load readings, the spring is deflected until it is perfectly flat





(Above): Stack of electrically-heated dies with 250-ton hydraulic press attachment used to produce the "dish" in the diaphragm. Following this operation, the discs are normalized

(Left): After completion of forming operations, while still flat, the discs are heat-treated in this electric furnace with controlled atmosphere

Follows Through in Chevrolet Clutch Spring Production

By JOSEPH GESCHELIN

WITH the announcement of the 1938 Chevrolet, came the news of one of the most novel developments in clutch design in many years. Here was a simple clutch assembly in which all of the customary spring elements had been eliminated, and in their place was a single clutch spring of dished disc type having 18 tapered spring fingers punched in the disc.

The spring, as illustrated, is made from hot rolled spring steel stock which is cross-rolled to provide an accurate control of stock thickness and grain flow. The nominal outside diameter is 9 in. A characteristic of this spring is the special load-deflection curve illustrated here.

Since both clutch function and life are dependent upon this clutch spring, its initial development entailed a lengthy research program designed to study the fatigue properties as well as the elements that required control in the manufacturing process. It was estimated at first that the spring must withstand an average of 750,000 reversals of stress to assure freedom from breakage or loss of properties during the normal life of the car. Later events proved that the endurance limit of

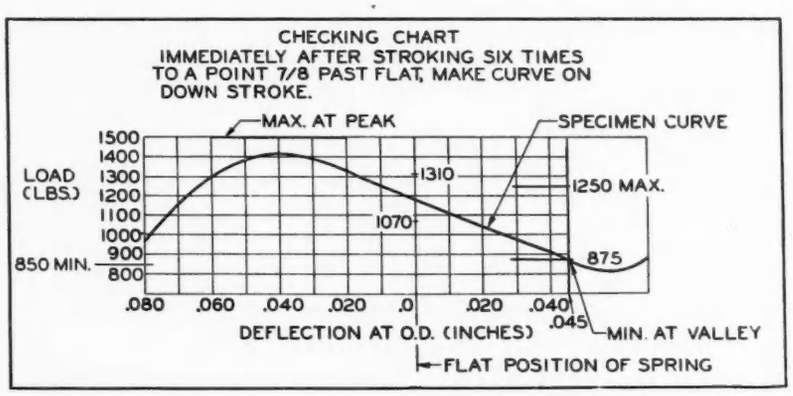
(Above): Following punch press operations, each disc is ground on both sides in this special double-end Gardner disc grinder, one of a battery

(Left): After "dishing" and normalizing, the springs proceed to this American Tumblast machine where each piece is shot-blasted to impart the high endurance limit in this stressed element. As shown, each piece is handled twice, once for each side in suitable fixtures

Routing of Chevrolet Clutch Spring

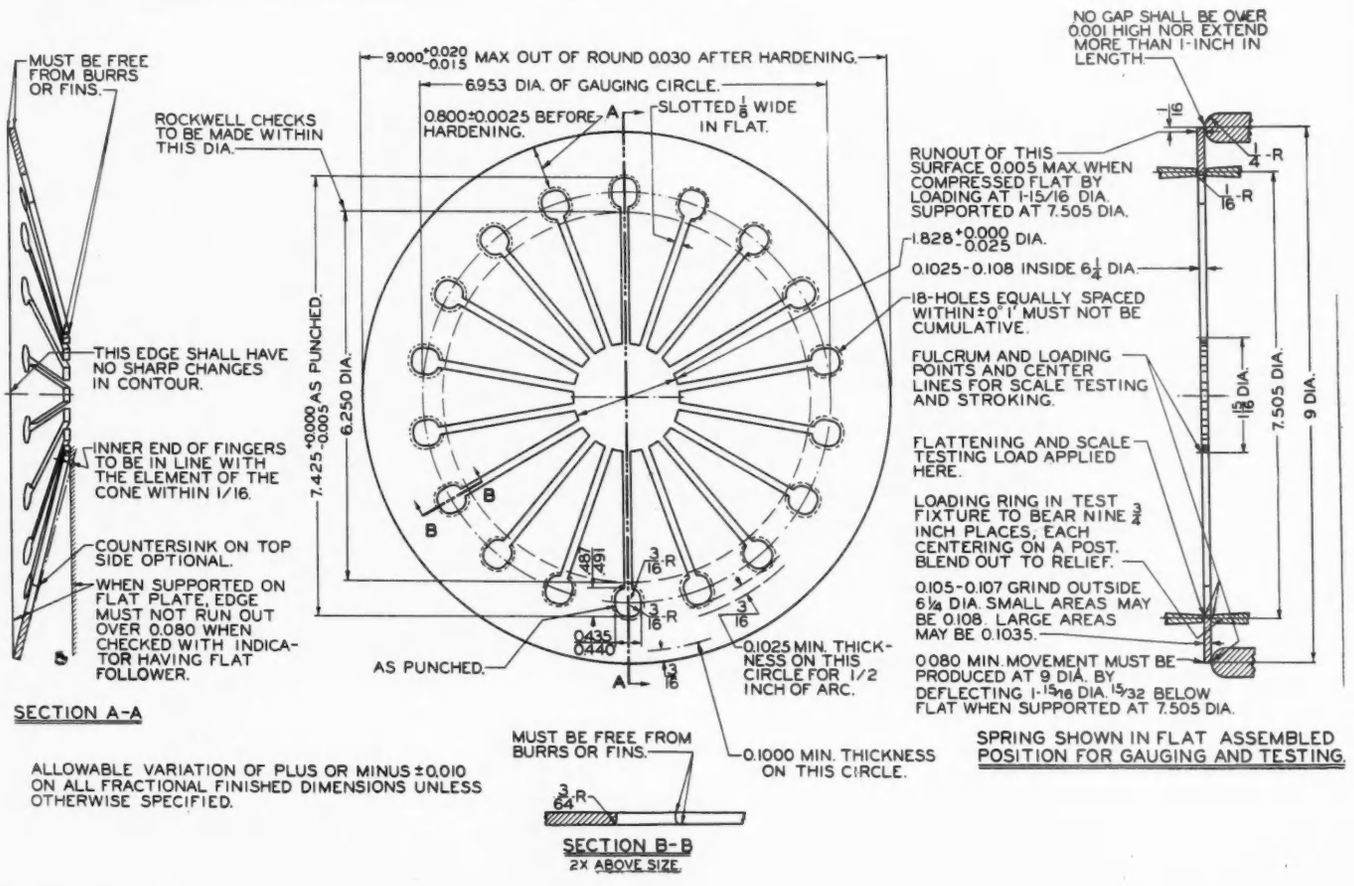
OPERATION	MACHINE
Blank and pierce 18 holes and center hole	No. 79½ Bliss press
Plug gauge small holes	
Gauge location of small holes	
Pierce 18 slots (two operations with indexing die)	No. 306 Bliss press
Heat to 925 deg. Fahr.	Furnace
Flatten	No. 21-E Cleveland press
Grind sides	Gardner grinder
Countersink 18 holes	No. 21-S Cleveland press
Gauge location of small holes	
Plug gauge countersunk holes	
Plug gauge (relation of slot to hole)	
Check thickness	Pratt & Whitney gage
Heat treat	Furnace
Form and draw temper	250-ton hydraulic press
Shot blast	American Tumblast machine
Flexing test	
Magnaflux test	Tank
Check for cracks	
Rockwell Test	
Gauge to check from small hole to edge of plate	
Gauge angle and location of small holes	
Flex and check load	Toledo scale

Drawing of the Chevrolet clutch diaphragm spring complete with dimensions and specification data



experimental springs was so high as to make it impractical and, indeed, unnecessary to tie up the test equipment long enough to produce failure. Thus the par of 750,000 reversals of stress has become simply a minimum specification.

From a manufacturing viewpoint, the process has been worked out in very simple and direct fashion, facilities for the entire output of clutches


MUST BE FREE FROM BURRS OR FINS.
ROCKWELL CHECKS TO BE MADE WITHIN THIS DIA.
THIS EDGE SHALL HAVE NO SHARP CHANGES IN CONTOUR.
INNER END OF FINGERS TO BE IN LINE WITH THE ELEMENT OF THE CONE WITHIN 1/16.
COUNTERSINK ON TOP SIDE OPTIONAL.
WHEN SUPPORTED ON FLAT PLATE, EDGE MUST NOT RUN OUT OVER 0.080 WHEN CHECKED WITH INDICATOR HAVING FLAT FOLLOWER.
9.000 +0.020 -0.015 MAX OUT OF ROUND 0.030 AFTER HARDENING.
6.953 DIA. OF GAUGING CIRCLE.
0.800±0.0025 BEFORE HARDENING.
SLOTTED 1/8 WIDE IN FLAT.
7.425 +0.000 -0.005 AS PUNCHED.
6.250 DIA.
AS PUNCHED.
0.435 0.440
3/16-R
3/16
0.1025 MIN. THICKNESS ON THIS CIRCLE FOR 1/2 INCH OF ARC.
0.1000 MIN. THICKNESS ON THIS CIRCLE.
SECTION A-A
ALLOWABLE VARIATION OF PLUS OR MINUS ±0.010 ON ALL FRACTIONAL FINISHED DIMENSIONS UNLESS OTHERWISE SPECIFIED.
MUST BE FREE FROM BURRS OR FINS.
3/64 R
SECTION B-B
2X ABOVE SIZE.
NO GAP SHALL BE OVER 0.001 HIGH NOR EXTEND MORE THAN 1-INCH IN LENGTH.
RUNOUT OF THIS SURFACE 0.005 MAX. WHEN COMPRESSED FLAT BY LOADING AT 1-15/16 DIA. SUPPORTED AT 7.505 DIA.
1.828 +0.000 -0.025 DIA.
0.1025-0.108 INSIDE 6 1/4 DIA.
18-HOLES EQUALLY SPACED WITHIN ±0° 1' MUST NOT BE CUMULATIVE.
FULCRUM AND LOADING POINTS AND CENTER LINES FOR SCALE TESTING AND STROKING.
FLATTENING AND SCALE TESTING LOAD APPLIED HERE.
LOADING RING IN TEST FIXTURE TO BEAR NINE 3/4 INCH PLACES, EACH CENTERING ON A POST. BLEND OUT TO RELIEF.
0.105-0.107 GRIND OUTSIDE 6 1/4 DIA. SMALL AREAS MAY BE 0.108. LARGE AREAS MAY BE 0.1035.
0.080 MIN. MOVEMENT MUST BE PRODUCED AT 9 DIA. BY DEFLECTING 1-15/16 DIA. 15/32 BELOW FLAT WHEN SUPPORTED AT 7.505 DIA.
1/4-R
1/16-R
1 15/16 DIA.
7.505 DIA.
9 DIA.
SPRING SHOWN IN FLAT ASSEMBLED POSITION FOR GAUGING AND TESTING.

Immediately after dipping in the solution, the discs are checked on the Magnaflux tester and inspected visually for evidence of cracks and surface imperfections

for Chevrolet passenger cars and trucks being housed in a small, self-contained department. However, each step in the process has a definite meaning and is precisely controlled.

Mechanical and metallurgical controls assure high fatigue properties as well as the development of the desired spring characteristics. Thus we note that at the completion of press-operations, the flat disc is heated to 925 deg. Fahr. to relieve initial forming stresses, flattened, and then disc-ground on the stressed side not only to achieve the correct thickness but also to provide a smooth surface free from surface imperfections.

Upon passing through a series of detail operations, as noted on the routing, the disc, still flat, is heat-treated in a horizontal furnace with controlled atmosphere, from which it emerges with hardness ranging from 45 to 50 R_c. The discs then go to a battery of electrically heated furnaces, each one consisting of a vertical row of nine die stations. While heated, the dies are loaded by a 250-ton hydraulic press to produce the desired "dish" effect in the spring. After forming, the dished springs are tempered or normalized.

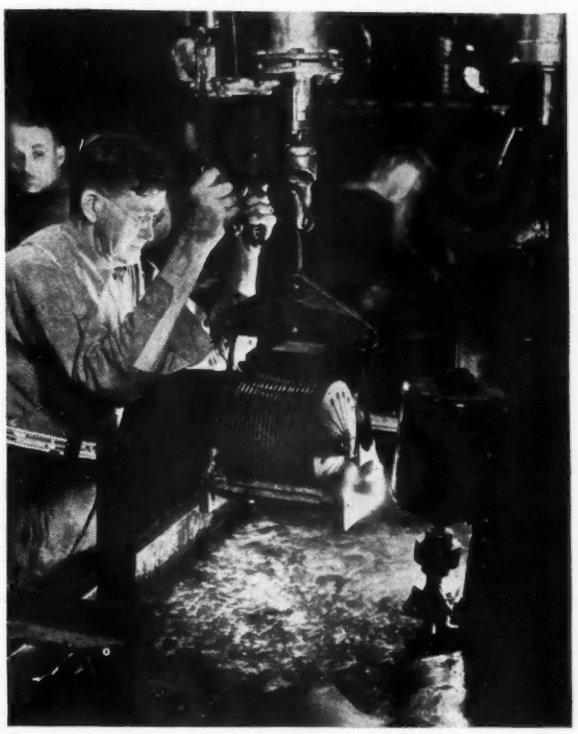
Formed springs then are shot blasted in an American Tumblast machine which removes all surface imperfections and produces a fine satin finish. The final operations, following this stage, consist of a series of quality control checks. First of all, each spring is loaded into a flexing machine which deflects the spring ⅞ in. past dead center, three times. Then each spring is immersed in a tank containing fine magnetic dust suspended in a liquid vehicle, and subjected to the Magnaflux test in which the strong magnetic flux will reveal unerringly even the most minute surface imperfections or microscopic cracks.

Each spring then is checked for hardness, gaged for other dimensions, and passes to the final test—load reading with the spring deflected to a flat position. The specification range of loading varies between 1070 and 1310 lb.

Not only is each of the quality controls a 100 per cent inspection but there is a positive and accurate control of all of the heat treating equipment in the department. For this purpose there is a large control room in an overhead gallery containing a series of banks of recording pyrometers and other meters, with a separate instrument for each station.

As a further precaution, the Magnaflux set-up is checked every hour by testing a specimen with known defects to make sure that the equipment is operating perfectly.

The complete sequence of manufacturing operations is listed in the accompanying table.



Stacks of finished springs are immersed in the tank containing the solution for the Magnaflux inspection. Note the Curtis air hoist used for handling the work.

AMERICAN STOCK CLUTCHES

MAKE AND MODEL	Designed for	Rated Torque Capacity	Type	Facing Material	DIAMETER OF FACING		Number of Facings	No. of Driving Members	No. of Driven Members	Disc or Plate Material	Number of Springs	PRESSURES (Lbs.)				Overall Outside Diameter of Clutch (Ins.)	Flexible Hub Mounting	Type of Throwout Bearing	DRIVE TAKEN BY		Means of Adjustment	Is Clutch Brake Provided	Bell Housing (S.A.E. Nos.)	Weight Complete (Lbs.)
					Outside (Ins.)	Inside (Ins.)						Total Spring Pressure	Total on Friction Face	Per Sq. In. of Friction Surface	To Disengage at Thrust Bearing				From Flywheel to Driving Members of Clutch	From Driven Members of Clutch to Clutch Shaft				
Borg & Beck 9A-6	C,T,Tr	(a)	SP	W-M	9¼	5⅝	2	2	1	St	9	1215	1215	28.7	275	11⅜	Sg	Opt	L.O.P.	Splines	No	No	5	16.5
Borg & Beck 10A-7	C,T,Tr	(b)	SP	W-M	10	6	2	2	1	St	9	1395	1395	27.9	300	12⅜	Sg	Opt	L.O.P.	Splines	No	No	5	19.35
Borg & Beck 10A-8	C,T,Tr	(b)	SP	W-M	10	6	2	2	1	St	12	1620	1620	32.4	300	12⅜	Sg	Opt	L.O.P.	Splines	No	No	5	21.1
Borg & Beck 11A-6	C,T,Tr,B	(c)	SP	W-M	11	6½	2	2	1	St	12	1770	1770	27.0	365	13⅜	Sg	Opt	L.O.P.	Splines	No	No	4	28.5
Borg & Beck 12-Q & 12-QL	T,B,Tr	200	SP	Wo	11⅞	7¼	2	2	1	St	1	300	1590	23.0	350	12¼	Sg	Opt	Pins	Splines	Sc	No	3	33.25
Borg & Beck 13-Q	T,B,Tr	260	SP	Wo	12⅞	7¼	2	2	1	St	1	300	1590	17.8	350	13⅜	No	Opt	Pins	Splines	Sc	No	3	41.25
Borg & Beck 14-Q	T,B,Tr	375	SP	Wo	13⅞	7¼	2	2	1	St	1	350	2117	19.3	400	14⅜	No	Opt	Pins	Splines	Sc	No	2	57.0
Brown-Lipe 12-SP	T,B,Tr	Var	SP	Wo	11.87	7.25	2	1	1	NI	1	Var	Var	Var	Var	13.37	Sg	BT	Keys	Splines	Shs	No	2,3,4	38.0
Brown-Lipe 13-SP	T,B,Tr	Var	SP	Wo	12.87	7.25	2	1	1	NI	1	Var	Var	Var	Var	14.62	Sg	BT	Keys	Splines	Shs	No	1,2,3	45.0
Brown-Lipe 14-SP	T,B,Tr	Var	SP	Wo	13.75	7.37	2	1	1	NI	2	Var	Var	Var	Var	15.50	Sg	AB	Keys	Splines	Th	Y	1,2,3	58.0
Brown-Lipe 13-2P	T,B,Tr	Var	DP	Wo	13.00	7.37	4	2	2	NI	2	Var	Var	Var	Var	15.50	No	AB	KP	Splines	Th	Y	1,2,3	84.0
Brown-Lipe 14-2P	T,B,Tr	Var	DP	Wo	13.75	7.37	4	2	2	NI	2	Var	Var	Var	Var	16.25	No	AB	KP	Splines	Th	Y	1,2	95.0
Fuller 1-SC-10	T,B,Tr	Var	MD	Wo	8.16	5.87	10	5	4	St	1	480	480	1.91	480	11.50	No	BT	GT	Pins	No	No	1,2,3,4,5	93.0
Fuller 1-SC-12	T,B,Tr	Var	MD	Wo	8.16	5.87	12	6	5	St	1	480	480	1.59	480	11.50	No	BT	GT	Pins	No	No	1,2,3,4,5	95.0
Fuller 1-SC-14	T,B,Tr	Var	MD	Wo	8.16	5.87	14	7	6	St	1	535	535	1.54	535	11.50	No	BT	GT	Pins	No	No	1,2,3,4,5	97.0
Fuller 1-SC-10-10	T,B,Tr	Var	MD	Wo	9.87	6.75	10	5	4	CI	1	725	725	1.78	725	11.50	No	BT	GT	Pins	No	No	1,2,3	116.0
Fuller 1-SC-10-12	T,B,Tr	Var	MD	Wo	9.87	6.75	12	6	5	CI	1	725	725	1.48	725	11.50	No	BT	GT	Pins	No	No	1,2,3	122.0
Hele-Shaw(1) 5	T,B,	210	MO	No	7.00	6.00	....	15	14	BS	1	250	....	62.0	250	10.50	....	AB	Pins	Pins	Th	Y	.....	58.0
Hele-Shaw(1) 6	T,B	300	MO	No	9.00	7.00	....	12	11	BS	1	300	....	56.0	300	12.75	....	AB	Pins	Pins	Th	Y	.....	82.0
Hele-Shaw(1) 7	T,B	370	MO	No	9.00	7.00	....	15	14	BS	1	300	....	56.0	300	12.75	....	AB	Pins	Pins	Th	Y	.....	86.0
Hele-Shaw(1) 8	.....	420	MO	No	11.50	9.50	....	12	11	BS	1	400	....	38.0	400	15.50	....	AB	Pins	Pins	Th	Y	.....	110.0
Hele-Shaw(1) 10	T,B	575	MO	No	11.50	9.50	....	16	15	BS	1	400	....	38.0	400	15.50	....	AB	Pins	Pins	Th	Y	.....	150.0
Hele-Shaw(1) 150	T,B	1000	MO	No	17	15.00	....	17	16	BS	1	600	....	54.0	600	21.50	....	AB	Pins	Pins	Th	Y	.....	300.0
Jones(2) 29	C,T,B	530	DP	W-M	8.87	5.25	4	2	2	St	24	1500	1500	....	300	11.25	Sr	BT	GT	Splines	No	No	5+	28.0
Jones(2) 33-A-C	C,T,B,Tr	450(m)	DP	W-M	9.87	6.38	4	2	2	St	24	Var	Var	Var	Var	11.50	Sr	....	.....	Splines	No	No	5+	33.0
Jones(2) 35	C,T	180–250	SP	W-M	8.87	6.37	2	1	1	St	12	Var	Var	Var	Var	11.50	Sr	BT	.....	Splines	No	No	5+	17.0
Jones(2) 30	C,B,Tr	150–285	SD	W-M	9.87	6.37	2	1	1	St	24	Var	Var	Var	333(m)	12.00	Sr	BT	.....	Splines	No	No	4+	24.0
Jones(2) 37	C,T,B,Tr	360(m)	SD	W-M	10.87	6.37	2	1	1	St	24	Var	Var	Var	285(m)	12.75	Sr	BT	.....	Splines	No	No	3,4,5	29.0
Jones(2) 1300	T,B	350–509	SP	W-M	12.87	7.00	2	1	1	St	24	2300(m)	Var	Var	348(m)	14.50	Sr	BT	.....	Splines	No	No	1,2,3	61.0
Jones(2) 1300-D	T,B	.....	DP	W-M	12.87	7.00	4	2	2	St	24	2300(m)	Var	Var	230-348	14.75	Sr	BT	.....	Splines	No	No	1,2,3	92.0
Jones(2) 1400-O	T,B	1100(m)	DP	W-M	13.87	7.50	4	2	2	St	24	230-2300	200	200	230-348	15.50	Sr	BT	.....	Splines	No	No	1,2	97.0
Jones(2) 45	C,T,B,Tr	250–355	SD	W-M	11.87	9.37	2	1	1	St	24	Var	Var	Var	353(m)	13.37	Sr	BT	.....	Splines	No	No	3,4,5	36.0
Lipe, W.C. Z-34-S	T,B,Tr	200	SP	W-M	11.87	7.25	2	1	1	St	1	375	1950	28.0	425	13.62	Sg	BP	Lugs	Splines	Shs	No	4+	37.2
Lipe, W.C. Z-30-S	T,B,Tr	265	SP	W-M	12.87	7.25	2	1	1	St	...	375	2300	26.0	425	14.62	Sg	BP	Lugs	Splines	Shs	No	3+	45.1
Lipe, W.C. Z-32-S	T,B,Tr	350	SP	W-M	13.87	7.25	2	1	1	St	1	400	2400	18.0	465	15.62	Sg	BT	Lugs	Splines	Shs	No	3+	57.0
Lipe, W.C. Z-31-S	T,B,Tr	425	SP	Wo	13.87	7.25	2	1	1	St	1	485	3300	31.0	530	15.62	Sg	BT	Lugs	Splines	Shs	No	3+	60.5
Lipe, W.C. Z-33-S	T,B,Tr	515	SP	Wo	15.00	8.00	2	1	1	St	1	485	2600	25.0	530	16.75	Sg	BT	Lugs	Splines	Shs	No	2+	68.0
Lipe, W.C. Z-33-SX	T,B,Tr	615	SP	Wo	15.00	8.00	2	1	1	St	1	520	4100	32.0	570	16.75	Sg	BT	Lugs	Splines	Shs	No	2+	71.7
Lipe, W.C. Z-37-S	T,Tr	650	DP	Wo	12.87	7.25	4	2	2	St	1	485	2400	26.9	530	15.62	Sg	BT	PL	Splines	Shs	No	3+	83.4
Lipe, W.C. Z-38-S	T,Tr	1000	DP	Wo	14.50	8.00	4	2	2	SI	1	520	3600	32.5	570	16.75	No	BT	PL	Splines	Shs	No	2+	90.7
Long 7½-CB	Cars	60	SP	W-M	7.50	5.00	2	2	1	St	6	Var	Var	Var	Var	8.18	Sg	BA	CS	Splines	No	No	.....	10.5
Long 8½-CB	C,T	125	SP	W-M	8.50	6.00	2	2	1	St	6	Var	Var	Var	Var	9.93	Sg	BA	CS	Splines	No	No	6+	10.75
Long 9-CF	C,T	(g)	SP	W-M	9.00	5.75	2	2	1	St	6	Var	Var	Var	Var	11.00	Sg	BA	CS	Splines	No	No	5+	14.50
Long 9½-CF	C,T	(h)	SP	W-M	9.50	6.00	2	2	1	St	6	Var	Var	Var	Var	11.50	Sg	BA	CS	Splines	No	No	5+	15.75
Long 10-CF	C,T,B,Tr	(d)	SP	W-M	10.00	6.00	2	2	1	St	9	Var	Var	Var	Var	12.00	Sg	BA	CS	Splines	No	No	5+	20.50
Long 11-CF	C,T,B,Tr	(e)	SP	W-M	11.00	6.50	2	2	1	St	9	Var	Var	Var	Var	13.00	Sg	BA	CS	Splines	No	No	4+	23.75
Long 12-CB	C,T,B,Tr	(f)	SP	W-M	12.00	7.00	2	2	1	St	12	Var	Var	Var	Var	14.62	Sg	BA	CS	Splines	No	No	3+	37.75
Long 29-A	T,Tr	225	DP	W-M	9.75	6.25	4	3	2	St	12	Var	Var	Var	Var	11.75	No	BA	Lugs	Splines	No	No	4+	33.00
Long 31-A	T,Tr	300	DP	W-M	11.00	6.50	4	3	2	St	12	Var	Var	Var	Var	13.00	No	BA	Lugs	Splines	No	No	4+	44.00
Long 34-BD	T,Tr	550	DP	W-M	13.75	7.25	4	3	2	St	18	Var	Var	Var	Var	16.12	No	BA	Lugs	Splines	No	No	2+	99.25
Long 13-6	T,B,Tr	350	SP	W-M	13.75	7.25	2	2	1	St	18	Var	Var	Var	Var	15.50	Sg	BA	CS	Splines	Sc	No	2+	63.50
Long 15-4	T,B,Tr	500	SP	W-M	15.50	9.00	2	2	1	St	18	Var	Var	Var	Var	17.75	Sg	BA	CS	Splines	Sc	No	1+	75.50
Long 17	T,B,Tr	600	SP	W-M	16.75	10.00	2	2	1	St	30	Var	Var	Var	Var	19.37	No	BA	CS	Splines	Sc	No	1+	96.00
Rockford 8-II	C,T	98	SP	W-M	7.87	5.37	2	1	1	St	6	720	720	27.6	213	9.18	Sg	Opt	Studs	Splines	SCL	No	4,5	.....
Rockford 9-II	T,B	145	SP	W-M	8.87	5.75	2	1	1	St	6	930	930	25.9	221	10.18	Sg	Opt	Studs	Splines	SCL	No	2,3,4,5	.....
Rockford 10-II	T,B,Tr	170	SP	W-M	9.87	6.62	2	1	1	St	6	990	990	23.5	235	11.18	Sg	Opt	Studs	Splines	SCL	No	2,3,4,5	.....
Rockford 11-II	T,B,Tr	262	SP	W-M	10.87	6.87	2	1	1	St	9	1375	1375	25.0	350	12.18	Sg	Opt	Studs	Splines	SCL	No	2,3,4	.....
Rockford 12-II	T,B,Tr	347	SP	W-M	11.87	6.87	2	1	1	St	9	1665	1665	22.6	420	13.18	Sg	Opt	Studs	Splines	SCL	No	2,3,4	.....
Rockford 14-II	T,B,Tr	590	SP	W-M	13.87	8.00	2	1	1	St	12	2460	2460	24.3	575	15.37	Sg	Opt	Studs	Splines	SCL	No	1,2,3	.....
Rockford 9-RR	Trucks	173	SP	W-M	8.87	5.75	2	1	1	St	6	1110	1110	30.9	265	10.18	Sg	Opt	L.O.P.	Splines	SCL	No	2,3,4,5	.....
Rockford 10-RR	T,B,Tr	.....	SP	W-M	9.87	6.62	2	1	1	St	6	1170	1170	27.7	285	11.18	Sg	Opt	L.O.P.	Splines	SCL	No	2,3,4,5	.....
Rockford 9-TT	T,B	210	SP	W-M	9.00	5.75	2	1	1	St	12	1350	1350	36.0	295	11.31	Sg	Opt	L.O.P.	Splines	Sc	No	2,3,4,5	.....
Rockford 10-TT	C,T,B,Tr	225	SP	W-M	9.87	6.12	2	1	1	St	12	1500	1500	32.0	350	12.00	Sg	Opt	L.O.P.	Splines	Sc	No	2,3,4,5	.....
Rockford 11-TT	C,T,B,Tr	320	SP	W-M	10.87	6.87	2	1	1	St	12	1740	1740	31.8	435	13.00	Sg	Opt	L.O.P.	Splines	Sc	No	2,3,4	.....
Rockford 12-TT	T,B,Tr	540	SP	W-M	11.87	6.87	2	1	1	St	15	2175	2175	35.0	435	14.62	Sg	Opt	Studs	Splines	Sc	No	2,3,4	.....
Rockford 14-TT	T,B,Tr	635	SP	W-M	13.87	8.00	2	1	1	St	12	2100	2100	21.8	420	15.50	Sg	Opt	Studs	Splines	Sc	No	1,2,3	.....
Rockford 18-TT	T,B,Tr	1960	DP	Wo	17.62	9.62	4	2	2	St	16	3360	3360	19.5	570	21.00	No	AB	Studs	Splines	Sc	No	0,00	.....
Rockford 15-Q	T,B,Tr	690	SP	Wo	15.00	8.00	2	1	1	St	9	2880	2880	22.8	690	17.25	No	AB	L.O.P.	Splines	SSP	No	1,2,3	.....

ABBREVIATIONS

+—And larger
(1)—Merchant and Evans Co.
(2)—Interstate Motive Parts Co.
(a)—150 lbs. on Pass. Cars, 120 on Trucks and Tractors
AB—Annular Ball
(b)—185 lbs. on Pass. Cars, 150 on Trucks and Buses
B—Buses
BA—Ball Thrust or Annular Ball
BP—Ball or Plain Thrust
BS—Bronze and Steel
BT—Ball Thrust
(c)—250 lbs. on Pass. Cars, 180 on Trucks, Buses or Tractors
C—Cars
CI—Cast Iron
CS—Cap Screws
(d)—Cars 225, Trucks 160, Buses and Tractors 130
DP—Double Plate, dry
(e)—Cars 275, Trucks 185, Buses and Tractors 170
(f)—Cars 375, Trucks 250, Buses and Tractors 200
(g)—Cars 165, Trucks 135
GT—Gear Teeth
(h)—Cars 185, Trucks 150
KP—Keys and Pins
L.O.P.—Lugs on Pressure Plate
(m)—Maximum
MD—Multiple Disc, Dry
MO—Multiple Disc, in Oil
NI—Nickel Iron
PL—Pins and Lugs
Sc—Screws on Cover Plate
SCL—Screws on Clutch Lever
SD—Single and Double Plate
Sg—Springs
Shs—Shims
SI—Spiral Iron
SP—Single Plate, Dry
Sr—Springs and Rubber
SSP—Screws in Studs in Pressure Plate
St—Steel
T—Trucks
Th—Threaded Ring
Tr—Tractors
Var—Various
W-M—Woven or Molded
Wo—Woven
Y—Yes

An Analysis of 68 Stock Clutches

IN the accompanying table are given the specifications of friction clutches for use on passenger cars, trucks, tractors and buses, produced by eight different manufacturers, a total of 68 models being listed. Four of the manufacturers do not make clutches for passenger cars.

Torque capacities of the clutches listed range from 60 to 1960 lb-ft., so that if we assume that the maximum torque of an engine is 0.75 lb-ft. per cu. in. displacement, these clutches will serve for a range of engine displacements extending from 80 to 2600 cu. in. It is noteworthy that clutches made for use on either passenger cars or commercial vehicles generally have a dual rating, and some even have a triple rating. The work of a clutch comes in starting, and that service is most severe in which the greatest number of starts and stops are made in a given time. Starts undoubtedly are most frequent in city buses, and clutches for this type of vehicle have the lowest rating, which in some cases is only about 50 per cent that of the same clutch for passenger-car use. The rating for trucks is about 70 per cent that for passenger cars.

The great majority of the clutches are of the familiar single-plate type, but one maker specializes in multiple-disc dry clutches and another in multiple-disc in-oil clutches.

The torque rating of a given type of clutch for a given service should vary as the cube of its diameter, because the frictional area will vary as the square of the diameter, hence with uniform unit pressure on the friction surfaces the frictional force will vary as the square of the diameter and the radius on which this force acts varies as the diameter. The average torque rating of all of the single-plate clutches listed is approximately 0.172 D^3 lb-ft., where D is the outside diameter of the friction linings in inches. Of course, the cooling area varies only as the square of the linear dimensions and this would make it more difficult to get rid of the heat generated in large clutches if the operating conditions were exactly the same. However, the engines with which the larger clutches are used usually operate at lower speeds, and the heat generated in the clutch during acceleration depends upon the product of the torque and the speed range.

Of the seven manufacturers who make clutches with friction facings, all supply woven facings on all models, and five also supply molded facings if desired, two of them on all of their models.

Driven discs are made of steel in the great majority of the models, but cast iron, either unalloyed or alloyed, is used in some of the larger clutches.

Friction clutches of the type now generally used for automotive applications may be divided into two groups according to whether the springs act directly in pressing the friction members together, or whether the spring force is multiplied by leverage. In 34 of the models listed the springs act directly on the friction members. In these clutches the average spring pressure is 27.5 lb. per sq. in. of frictional area. In clutches in which the spring pressure is multiplied by levers the average specific pressure is slightly less, viz., 25.4 lb. per sq. in. of frictional area. In these latter clutches the average ratio of spring-force multiplication by levers is almost exactly 6.

The average inside diameter of the linings in single-plate clutches is 0.6 D, where D is the outside diameter. Consequently, the frictional area of one lining is $(D^2 - 0.36\ D^2) \times 0.7854 = 0.502\ D^2$.

The average spring pressure in all single-plate clutches is about 26 lb. per sq. in. However, not all of this pressure is effective in pressing the plates together, some of it being lost in overcoming friction. If we take the mechanical efficiency of the springs and the parts through which they act to be 85 per cent, then the actual specific pressure on the friction surfaces is

$$0.85 \times 26 = 22.1 \text{ lb. per sq. in.}$$

and the total effective pressure on the friction lining is

$$0.502\ D^2 \times 22.1 = 11.1\ D^2 \text{ lb.}$$

This makes the total frictional force on one lining 11.1 D^2f, where f is the friction coefficient. The outer radius of the friction surface being 0.5 D and the inner radius 0.3 D, the mean radius, is 0.4 D, hence the moment (or torque) of the frictional force on one lining is

$$0.4\ D \times 11.1\ D^2f = 4.44\ D^3f \text{ lb-in. or}$$

$$4.44\ D^3f/12 = 0.37\ D^3f \text{ lb-ft.}$$

In a single-plate clutch there are two surfaces on which there is a frictional force that must be overcome before slipping can take place, and the combined frictional moment or ultimate torque, therefore, is 0.74 D^3f lb-ft.

We found that the average rated torque capacity is 0.172 D^3. The ultimate capacity is equal to the rated capacity multiplied by a certain coefficient of reserve, which we may call r. Then

$$0.172\ D^3r = 0.74\ D^3f,$$

and

$$f/r = 0.232,$$

so that if a friction coefficient f of 0.3 can be figured with, the coefficient of reserve works out to

$$0.3/0.232 = 1.29$$

Where the throw-out bearing is coaxial with the clutch spring, the thrust load on it is usually figured as 50 lb. more than the spring pressure. Two makers make the type of throw-out bearing optional; in all other cases either a ball-thrust bearing or an annular ball bearing is used. The load on the throw-out bearing varies through a considerable range, from 200 lb. to 725 lb. In multiple disc dry clutches the specific pressure on the friction facings is much lower, between about 1.5 and 2.0 lb. per sq. in.

There is considerable variation in

(Turn to page 60, please)

Just Among Ourselves

Hudson Sets a New Pace

NEWS of the week industrially is undoubtedly Hudson's entrance into the low-price field with a 112-in. car. The move has considerable significance, both from Hudson's standpoint and that of the industry. Hudson's financial position has improved to the point where such a move could be undertaken with confidence.

Of broader significance is the fact that Hudson and some other manufacturers in the industry found themselves in an outsize price bracket after the 1937 automobile show dust settled out of the atmosphere. Hudson's move toward a lower bracket will undoubtedly be followed by other manufacturers if they can put themselves in a position to make the move.

The longer the recession continues, the more important will be the price factor in 1938 automobile sales. The accountants will be carefully comparing the cost of model changes, with the attendant profit possibilities of increased volume, against the possibility of maintaining volume with present models above the break-even point in production.

Individual companies, for competitive reasons, are naturally keeping their specific plans for meeting the problem under the hat. Hudson by making the first move, has cut itself a slice of the year's best market. Herewith, best wishes for success!

Out of Washington Will Come—

MOST analyses of sentiment in Washington agree that President Roosevelt is still, in spirit, a crusader. Within the past several weeks there have been ways in which this emanation of the Washington spirit affected our own industries. In Milwaukee, a Federal judge dismissed a case involving finance companies and automobile companies in charges of coercion of automobile dealers. Immediately, the attorney general wrote to the House Judiciary Committee (which initiates impeachments) suggesting that the case be called for investigation.

There is considerable evidence that that case will rise from its ashes, either on the floor of Congress, or in a new Federal jurisdiction. To believe otherwise is to ignore evident facts. The case has facets of interest to every branch of the automotive industries, and we are therefore reviewing its status in next week's issue of AUTOMOTIVE INDUSTRIES. The story involved three phases: jurisdiction in Milwaukee, finance companies in New York, and Government attitude in Washington. So we are having it written in three parts. Seasoned correspondents in the three cities will interpret the story from the local standpoint, and we believe the resulting triptych will be the most complete review of this particular situation that has yet been published.

Automotive Talent Spreads Out

IN an analysis of the automotive parts and accessories industry, Poor's Financial Reports makes the following trenchant statement: "In recent years, the production of non-automotive lines has assumed a position of major importance to many companies. Such products, which in several individual cases, account for up to 50 per cent of volume, are sold to a diversity of industries as well as to household consumers."

Introduction by Bendix of a "household laundry" is one of the latest and most spectacular ventures in this line. Competent observers in the domestic utilities field believe the Bendix product may revolutionize the design of household washing equipment. It's interesting to us to see how principles of automotive engineering, when carried over into another field, produce something revolutionary. Bendix has made immense strides in making the motor vehicle more automatic. When it turns to the washing-machine field, it carries over the same thinking, and the results are startling.

More Regarding that Functional Design

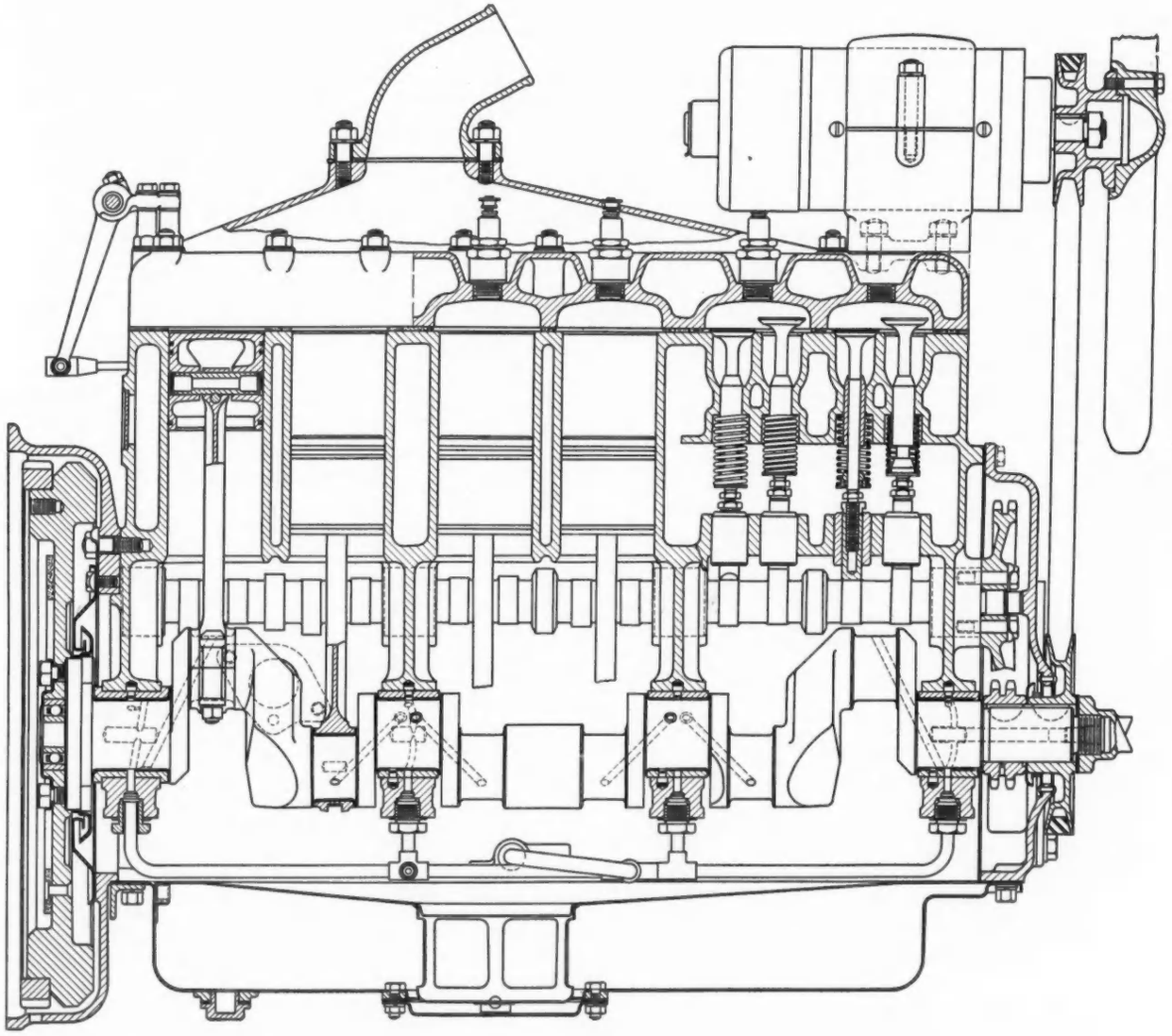
AND that reminds us of something else of a related nature. During the past 10 years or so, there has been much discussion about an automobile of functional design.

Mechanically speaking, we believe the last three years have seen much progress toward functional operation of automobiles and other motor vehicles. In other words, the trend toward automaticity, of reducing the number of manual operations which the driver must perform can be construed as functional progress. So can the reduction of noise and heat transmitted to the passenger, improvements in riding comfort, reduction of vehicle weights, etc.

But when exterior design comes into view, it's our personal opinion that very little progress has been made. Consider the poor visibility in many cars, the amount of excess tinware, and the many attempts to achieve smooth forms and faired styling by the use of moldings and other decorative elements which are no part of the fundamental design. Almost every 1938 car which comes to mind has some excellent inherent lines, designed functionally to carry out a particular idea, and then goes inconsistent at some point in the design with an added doo-dad or molding, or louver, or depression.

We believe that the public's ranking of 1938 cars from the appearance standpoint bears out some of these conclusions. The public wouldn't express its views the same way, but when a member of the public says, "I like the back end of that car but not the front," that's just another way of saying there's something inconsistent (and therefore non-functional) about the car's appearance.—H. H.

Number 11 of the Second Series of AUTOMOTIVE INDUSTRIES Engineering Drawings



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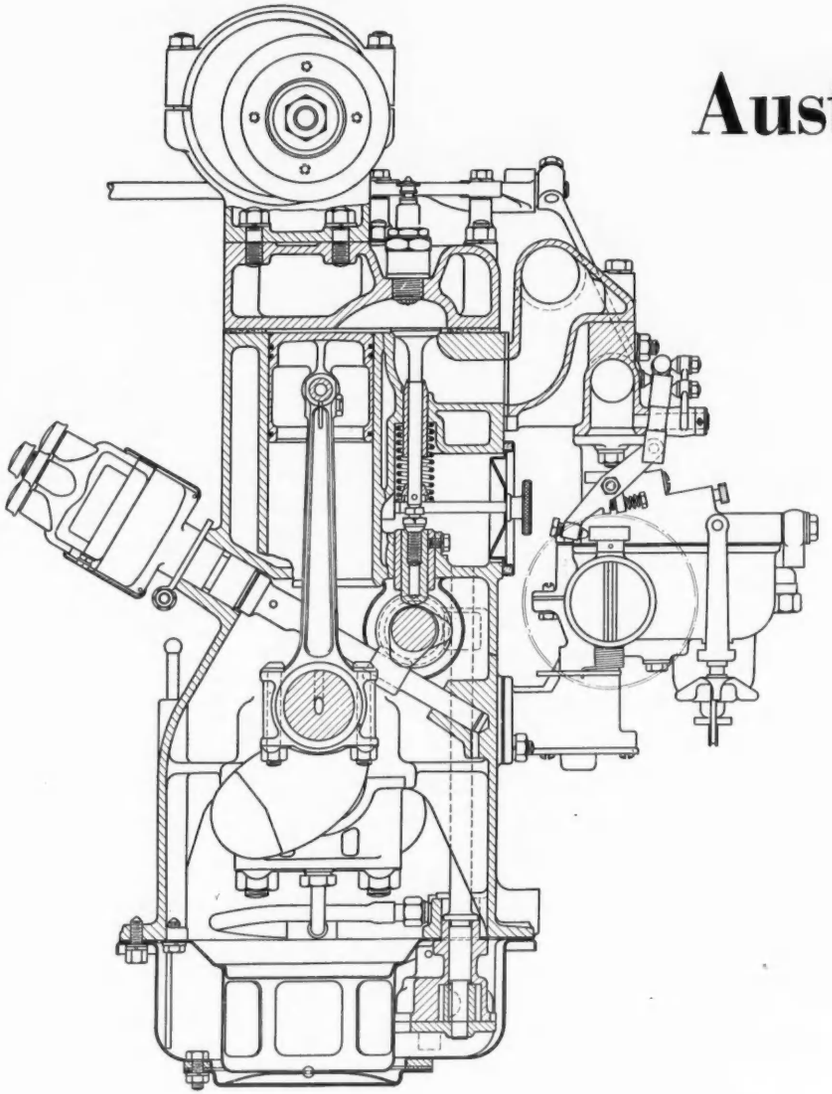
Austin Fourteen-Six

Longitudinal section through crankshaft axis. An unusual feature is that the valve springs extend into recesses in the cylinder block.

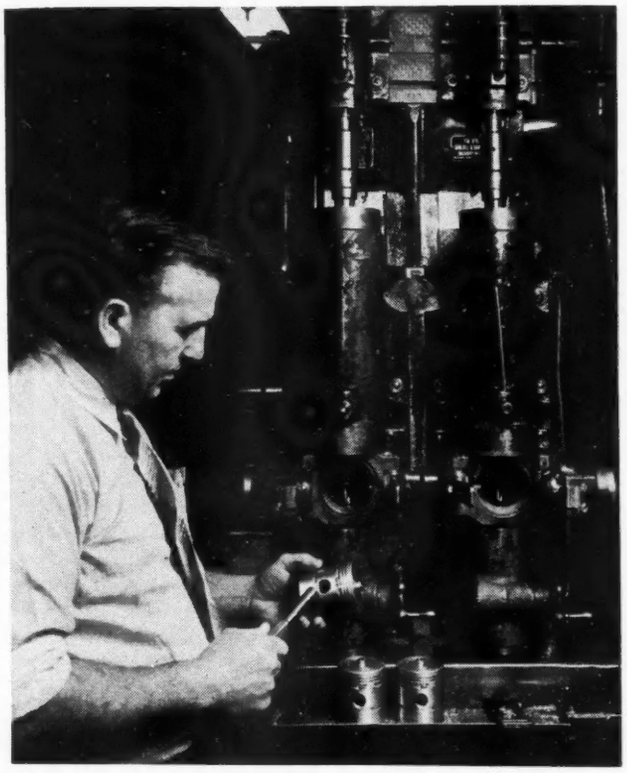


Austin Fourteen-Six Engine

Cross Section Through a Cylinder Axis

This engine has six cylinders with a bore and stroke of 2.58 by 3.335 in., which makes its displacement 104 cu. in. It develops 38.7 b.hp. at 3800 r.p.m., which corresponds to a b.m.e.p. of 77.5 lb. per sq. in. at the peaking speed. It has a three-point mounting on rubber, there being two forward mounting points and one behind the unit gearset. It has a four-bearing crankshaft with main journals of 1¾ in. and crankpins of 1⅝ in. diameter. Pistons are of aluminum alloy. The four camshaft bearings, of 1¾ in. diameter and 1¼ in. length, are directly on the cast iron of the crankcase. All cylinder barrels are separated by jacket spaces.

Fuel is fed to the downdraft carburetor (not shown in the drawings) by a mechanical pump. Cooling water is circulated by thermo-siphon effect, and a fan and a thermostatic valve in the riser from the cylinder head complete the cooling system. There is a gear-type pump for pressure lubrication to the crankshaft journals and "big ends." A suction filter is located at the center of the pressed-steel sump. Camshaft drive is by a duplex roller chain. The generator is mounted on the cylinder head and is belt-driven from the fan pulley.



Piston pin holes are drilled at the Hudson plant with a tolerance minus zero—plus 0.0003 using a diamond drill

Production Lines

Plus Strength

Not uncommon is the problem of what to do when an increased factor of safety is desired in a highly stressed part within the limitations of present size. Current research in the field of the endurance limit of metals for stressed parts points to a solution whose virtues have been tested beyond a doubt. Some of this was brought out at the Flint Production Meeting in December. Discussion revealed that shot-blasting the stressed surfaces with small shot produced an increase in endurance limit of from 100 to 300 per cent and more. We learned that Cadillac was shot-blasting axle shafts on axles intended for custom-built buses, thereby satisfying the need for greater load carrying capacity for the same size. The new Chevrolet clutch spring is shot-blasted all over to assure long life. Olds uses shot-blasting to improve the life of replacement axle shafts for obsolete models. Herein lies the nub of a very remarkable although simple solution to a hitherto insuperable problem.

Identity vs Standard

Ford's McCloud was asked about the progress of committee work on the standardization of color finishes, during the course of his Flint talk. His answer was brief and to our mind quite apt. McCloud feels that color "identification" rather than any "standardization" is the real problem. No one wants a system of standard colors for body finish; but everyone is interested in any rational method of specifying what is wanted.

Dressed Tips

Welding tips for resistance welding machines have the same relation to the process as the cutting tool to a metal cutting machine. Both are small but very vital elements of a big set-up. George Sieger brought out the important fact that in welding shops, not all welding shops perhaps, the welding tip has had but little consideration when it comes to maintenance. Welding men will agree that if the welding tip originally is a well-designed and carefully formed element, it should be dressed just as carefully when it wears down. Good welds are possible only with carefully controlled equipment.

Broaches Shaft

We have it on good authority that one of the biggest names in the electric motor manufacturing business has adopted a new and unique machine which finishes the entire shaft contour with its various diameters by surface broaching. It seems to us that this opens a tremendous field of exploration with the surface broaching method which seemingly has no bounds. Incidentally, the machine was developed by a prominent lathe manufacturer whose name we will give you gladly.

Short Annealed

Short cycle annealing for automobile castings has produced a remarkable change in foundry practice, reducing the annealing cycle from 120 hours to 12 hours in several exceptional cases. In four automotive foundries the annealing cycle is only 12 hours in two cases, 28 hours in one case, and 60 hours in a certain malleable iron foundry. The new method utilizes a controlled atmosphere in furnaces equipped with radiant heat tubes. It is now passing through an interesting stage of development in which is felt the influence of variations in metal mixtures, physical properties of different kinds of parts, and other variables, which undoubtedly will come to light. There is much in this process that should be of importance to production men, foundrymen, and metallurgists. —J. G.

An Analysis of Stock Clutches

(Continued from page 55)

the means by which the torque is transmitted from the flywheel to the driving plates. In some cases lugs on the pressure plate are employed, while in other cases pins, keys and gear teeth are made use of. The conventional method of transferring the torque from the driven member to the clutch shaft is by splines in the hub of the driven member and on the clutch shaft.

Twenty-eight of the 68 clutches have no means of adjustment. The means of adjustment provided in the other 40 models include screws, shims and threaded rings. Clutch brakes are provided only in two makes of clutches in which the driven members evidently have relatively large momentum.

As the weight of the clutch varies as the cube of its linear dimensions it would be expected that it would vary also in direct proportion to the torque capacity, and for any given type of clutch this is approximately the case. The average specific weight of all of the single- and double-plate clutches is substantially 0.14 lb. per lb-ft. of rated capacity.

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A Wider Market Awaits

(Continued from page 49)

motor taxes, administration, road maintenance work and construction no one will ever know.

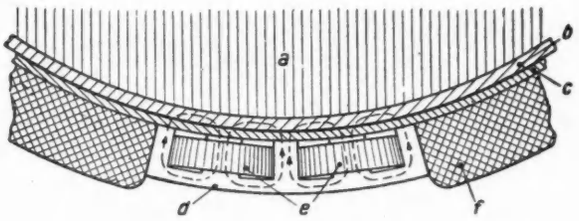
But with centralization of highway control in the hands of state highway departments which have been given independence of authority, and with these departments allotted all the money Mr. Motorist is already paying for road improvement, we would soon have a highway system that would favorably measure up to the standards of tomorrow's powerful, efficient and high-speed motor car.

The realization of this three-point program means plenty of hard work ahead. Only an aroused public opinion actively supported by millions of highway users could be strong enough to defeat the intrenched forces that want no change.

The 29,000,000 motor vehicle owners who are paying the annual billion-dollar highway bill are today unorganized, inarticulate. Their individual payment is less than $35 per year, and it is paid out, for the most part, only a few pennies at a time. These 29,000,000 can be roused to action—but there is need for leadership. And it is up to the industries whose welfare depends on good highways to provide this leadership.

An Apparatus for Heating Liquids by Induction

Quoting from the *Siemens Review* Nos. 1 and 2 for 1937, *La Technique Moderne* describes an apparatus for heating liquids by the induction system. Alternating curent from 50-cycle mains is used. The heating equipment forms a closed magnetic circuit of which a part is constituted by parts of the container or tank walls. The magnetic circuit comprises a primary and a secondary member. The primary consists of a transformer core carrying a winding which is supplied directly with current from the alternating mains. The magnetic flux originating in this core returns through a part of the wall of the container or tank, which also acts as the heating surface. As a rule a special composite sheet material is used for these containers, with a layer of a metal of high electric conductivity,



Arrangement for heating walls of a tank by electromagnetic induction

such as copper. Between the primary member and the wall of the container there is a layer of heat-insulating material, such as asbestos.

The rapidly alternating magnetic flux produces in the layer of high electrical conductivity eddy currents which produce the heating effect. Of course, such eddy currents are produced also in the magnetic material of the container sheet, and electrical energy is being converted into heat there too, but the object is to increase the rate of conversion per unit of heating surface to the maximum, and this end is attained by coating the magnetic material with a special layer of copper.

In the drawing herewith the heating arrangement is illustrated diagrammatically. The liquid to be heated (a) is in direct contact with the wall *b* of the container. Between the transformer core *d* and its winding *e* on the one hand and the container wall *b* on the other there is a layer *c* of asbestos. The remainder of the tank or container is heat-insulated in the usual manner, the insulation being indicated by *f* in the drawing. The direction of the magnetic flux is indicated by dotted lines and arrow heads.

The principle on which this process is based evidently requires that the walls of the container should be of magnetic material, that is, sheet iron or steel. Now, the material which is to be heated frequently determines the materials that must be used for the surfaces with which it comes into contact, and for the most part only laminated materials are used, that is steel sheet covered with a layer of non-ferrous metal on either one side or both, such as are now furnished by the rolling mills in all conceivable combinations, such as iron-nickel-iron, or steel, V2A-iron-copper. The manufacturing process consists in intimately uniting the non-ferrous metal to the steel or iron by hot-rolling. Nevertheless, in order to obtain the desired heating effect, it is only necessary to cover the outside of the sheet steel of the container with a layer of copper, the part of the container carrying the heating elements being a special copper-sheathed section welded in to container.

It results from the foregoing that it is possible to apply the induction-heating process even to existing containers or tanks, provided they are otherwise satisfactory for the purpose. It suffices to weld to them, above the heating elements, the section of the copper-coated steel sheet to which reference has been made. Such constructions have given entirely satisfactory results in practice, as much from the electrical and thermal standpoints as from that of the value of the products treated.—*La Technique Moderne*, Sept. 15.

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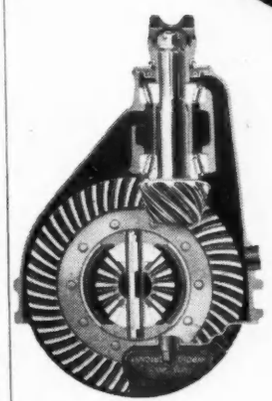

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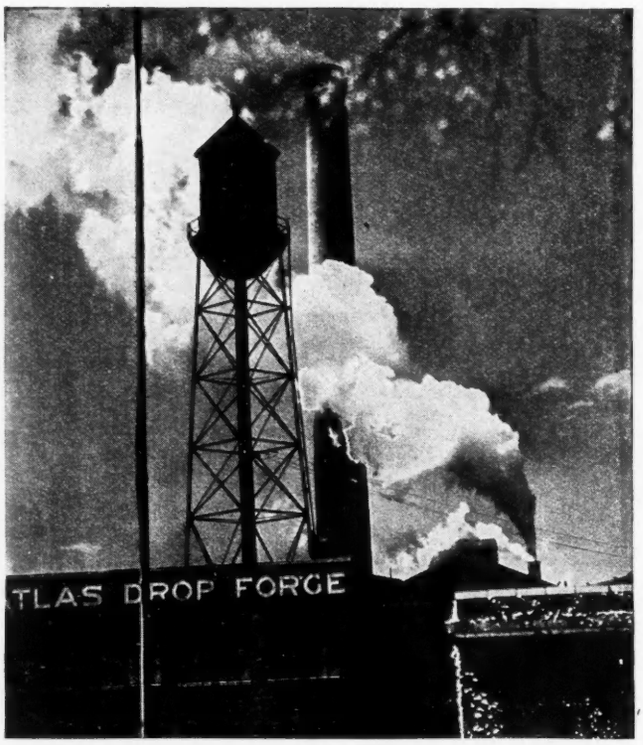

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◆ BUYERS' GUIDE ◆

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See Alphabetical List of Advertisers on page 39

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